ADDI-DATA®
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Important information

Communication boards

APCI-7300-3
APCI-7420-3
APCI-7500-3
APCI-7800-3

Pin assignments RS232 module

01.03-05/2008

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Please observe that during the migration to RoHS-compliant boards, the pin assignment of RS232 changed. Thus, there are differences between the different revision numbers of the printed circuit board. Therefore please check your revision number.

Thank you for your attention!

Board	Revision number	Latest technical documentation
APCI-7300-3 **APCI-7420-3** **APCI-7500-3**	Rev. A-C	See Rev. D, but with changed modem control signals DCD & DSR at RS232 modules.
	from Rev. D	Internet: Manual download Edition: 02.03 – 03/2007-b (and later editions)
APCI-7800-3	Rev. A-B	See Rev. C, but with changed modem control signals DCD & DSR at RS232 modules.
	from Rev. C	Internet: Manual download Edition: 02.03 – 03/2007-b (and later editions)

APCI-7300-3, APCI-7420-3, APCI-7500-3 and APCI-7800-3: 9-pin SUB-D connector

9-pin SUB-D connector pin assignment with changed modem control signals DCD & DSR. **APCI-7300-3, -7420-3, -7500-3: Rev. A-C** **APCI-7800-3: Rev. A-B**		Standard 9-pin SUB-D connector pin assignment **APCI-7300-3, -7420-3, -7500-3: from Rev. D** **APCI-7800-3: from Rev. C**	
Pin-No.	**Signal**	**Pin-No.**	**Signal**
1	DSR	1	DCD
2	RXD	2	RXD
3	TXD	3	TXD
4	DTR	4	DTR
5	GND	5	GND
6	DCD	6	DSR
7	RTS	7	RTS
8	CTS	8	CTS
9	RI	9	RI

APCI-7500-3: 37-pin SUB-D-connector

37-pin SUB-D connector pin assignment with changed modem control signals DCD & DSR. **APCI-7500-3:** Rev. **A-C**		Standard 37-pin SUB-D connector pin assignment **APCI-7500-3:** from **Rev. D**	
Pin-No.	**Signal**	**Pin-No.**	**Signal**
1, 10, 24, 33	DSR	1, 10, 24, 33	DCD
2, 11, 25, 34	RXD	2, 11, 25, 34	RXD
3, 12, 26, 35	TXD	3, 12, 26, 35	TXD
4, 13, 27, 36	DTR	4, 13, 27, 36	DTR
5, 14, 28, 37	GND	5, 14, 28, 37	GND
6, 15, 20, 29	DCD	6, 15, 20, 29	DSR

APCI-7800-3: 78-pin SUB-D connector

78-pin SUB-D connector pin assignment with changed modem control signals DCD & DSR. **APCI-7800-3:** Rev. **A-B**		Standard 78-pin SUB-D connector pin assignment **APCI-7800-3:** from **Rev. C**	
Pin-No.	**Signal**	**Pin-No.**	**Signal**
1, 6, 11, 16, 62, 67, 72, 77	RI	1, 6, 11, 16, 62, 67, 72, 77	RI
2, 7, 12, 17, 63, 68, 73, 78	DTR	2, 7, 12, 17, 63, 68, 73, 78	DTR
3, 8, 13, 18, 40, 64, 69, 74	GND	3, 8, 13, 18, 40, 64, 69, 74	GND
4, 9, 14, 20, 60, 65, 70, 75,	TXD	4, 9, 14, 20, 60, 65, 70, 75,	TXD
5, 10, 15, 19, 61, 66, 71, 76	RXD	5, 10, 15, 19, 61, 66, 71, 76	RXD
21, 23, 26, 31, 36, 48, 53, 58	DCD	21, 23, 26, 31, 36, 48, 53, 58	DSR
22, 27, 32, 37, 44, 49, 54, 59	DSR	22, 27, 32, 37, 44, 49, 54, 59	DCD
23, 28, 33, 38, 41, 45, 50, 55	CTS	23, 28, 33, 38, 41, 45, 50, 55	CTS
24, 29, 34, 39, 42, 46, 51, 56	RTS	24, 29, 34, 39, 42, 46, 51, 56	RTS

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Should you have questions
that you do not find in the manual
or on our website (http://www.addi-data.com),
please contact us by phone or e-mail:
info@addi-data.com

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Technical description

APCI-7300-3, APCI-7420-3, APCI-7500-3(/4C), APCI-7800-3

1-port, 2-port, 4-port, 8-port serial interface for the PCI bus

Edition: 02.05 - 12/2009

Product information

This manual contains the technical installation and important instructions for correct commissioning and usage, as well as production information according to the current status before printing.
The content of this manual and the technical product data may be changed without prior notice.
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WARNING

The following risks result from improper implementation and from use of the board contrary to the regulations:

- **Personal injury**

- **Damage to the board, PC and peripherals**

- **Pollution of the environment**

- **Protect yourself, the others and the environment!**

- **Read carefully the safety precautions (yellow leaflet).**

  If this leaflet is not with the documentation, please contact us and ask for it.

- **Observe the instructions of the manual.**

  Make sure that you do not forget or skip any step.
  We are not liable for damages resulting from a wrong use of the board.

- **Used symbols:**

IMPORTANT!
designates hints and other useful information.

WARNING!
It designates a possibly dangerous situation.
If the instructions are ignored the board, PC and/or peripheral may be destroyed.

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1 DEFINITION OF APPLICATION

1.1 Intended use

The board **APCI-7xxx-3**[1] must be inserted in a PC with PCI 5V/32 bit (PCI 3.3V/32 Bit) which is used as electrical equipment for measurement, control and laboratory pursuant to the norm EN 61010-1 (IEC 61010-1). The used personal computer (PC) must fulfil the requirements of IEC 60950-1 or EN 60950-1 and 55022 or IEC/CISPR 22 and EN 55024 or IEC/CISPR 24.
The use of the board **APCI-7xxx-3** in combination with external screw terminal panels requires correct installation according to IEC 60439-1 or EN 60439-1 (switch cabinet / switch box).

1.2 Usage restrictions

The **APCI-7xxx-3** board must not to be used as safety related part (SRP).

The board must not be used for safety related functions, for example for emergency stop functions.

The **APCI-7xxx-3** board must not be used in potentially explosive atmospheres.

The **APCI-7xxx-3** board must not be used as electrical equipment according to the Low Voltage Directive 2006/95/EC.

1.3 General description of the board

The board **APCI-7xxx-3** provides the personal computer (PC) with 1-port, 2-port, 4-port or 8-port asynchronous serial interface for the communication with external devices:

Board	Interface
APCI-7300-3	1-port
APCI-7420-3	2-port
APCI-7500-3, APCI-7500-3/4C	4-port
APCI-7800-3	8-port

The operating mode of the interface depends on the MX modules installed.

[1] Common designation in the manual for the boards **APCI-7300-3, APCI-7420-3, APCI-7500-3, APCI-7500-3/4C** and **APCI-7800-3**

The board is to be connected to the peripheral through a shielded cable, which shielding should be grounded on both ends.

Minimum specifications of the connection cable:
- metallised plastic hoods
- shielded cable
- cable shield folded back and firmly screwed to the connector housing.

The board supports serial communication through 1, 2 or 4 asynchronous serial ports. The use of the board depends on the following parameters (See table below).

Table 1-1: Different communication operating modes

Plug-in module[1]	Transmission standard	Maximum transmission rate[2]	Optical isolation	Interface setting	Distance between transmitter and receiver[3]
MX232	RS232	115 kbps	no	-	30 m
MX232-G			1 kV		
MX422	RS422	115 kbps	no	-	1.2 km
MX422-G MX422-PEP (RTS/CTS as RS422)			1 kV		
MX485	RS485	115 kbps	no	automatic transmitter control	1.2 km
MX485-G			1 kV	automatic transmitter control	
MXTTY	TTY (20 mA current loop)	19.2 kbps	1 kV	standby current on transmit and receive channel	1 km

If the basic board **APCI-7xxx-3** is used with optically isolated modules and non isolated modules, then the safety built by the creeping distance of 3.2 mm is not ensured for the non isolated modules.

Check the shielding capacity of the PC housing and cable prior to putting the device into operation.

The use of the board includes observing all advises given in this manual and in the safety leaflet.

---

[1] **MXxxx-G**: MX232-G, for example, stands for a plug-in module with the RS232 standard. The -G suffix means that the module is optically isolated. The MXTTY module is always optically isolated.

[2] Transfer rates > 115 kbps on the board xPCI-7xx0 are possible up to 1 Mbps by means of an equipment option.

[3] The indicated maximum lengths apply to normal interface cables (shielded control lead, 0.14 mm²). The length is also limited by the number of users, impedance, line capacity and transfer rate.

Uses beyond these specifications are not allowed. The manufacturer is not liable for any damages which would result from the non-observance of this clause.

Make sure that the board remains in the protective blister pack
until it is used.

For all operating modes, the signal lines are to be twisted in pairs with GND.
Use exclusively connection cable with twisted pairs.

The housing of the peripheral connector
- is to be firmly screwed together with the shield of the cable.
- is to assure a low-resistance connection (< 100 mΩ) between the shield and the housing of the PC.

The shield of the cable is to be earthed on both ends.

Do not remove or alter the identification numbers of the board.
If you do, the guarantee expires.

2 USER

2.1 Qualification

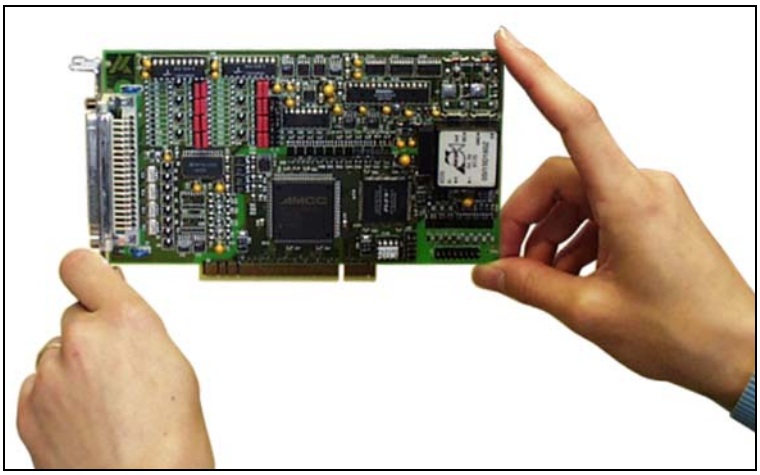
Only persons trained in electronics are entitled to perform the following works:
- installation
- use
- maintenance

2.2 Country-specific regulations

Consider the country-specific regulations about:
- the prevention of accidents
- electrical and mechanical installations
- radio interference suppression

3 HANDLING OF THE BOARD

Fig. 3-1: Correct handling



4 TECHNICAL DATA

4.1 Electromagnetic compatibility (EMC)

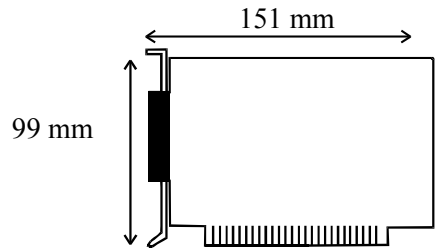
The board **APCI-7xxx-3** complies with the European EMC directive. The tests were carried out by a certified EMC laboratory in accordance with the norm from the EN 61326 series (IEC 61326). The limit values as set out by the European EMC directive for an industrial environment are complied with.

The respective EMC test report is available on request.

4.2 Physical set-up of the board

The boards **APCI-7500-3**, **APCI-4720-3** and **APCI-7300-3** are assembled on a 4-layer printed circuit card.

Dimensions:



Weight: ..... approx. 120 g
Installation in: ..... 32/64-bit PCI slot
(5 V and 3.3 V)

Connection to the peripheral:
APCI-7300-3: ..... 9-pin SUB-D male connector
APCI-7420-3: ..... 2 x 9-pin male SUD-D male connector
APCI-7500-3: ..... 37-pin SUB-D male connector
APCI-7500-3/4C: ..... 4 x 9-pin SUB-D male connector with 2nd slot

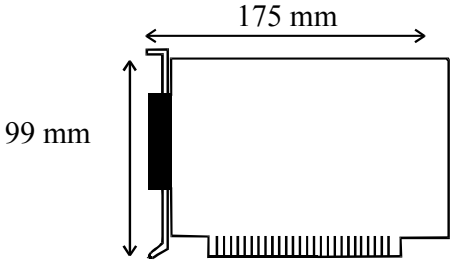
Connection cables for the APCI-7500-3[1]:
ST074:
37-pin SUB-D female connector to 4 x 25-pin SUB-D male connector
ST075:
37-pin SUB-D female connector to 4 x 9-pin SUB-D male connector

WARNING!
The supply lines must be installed safely against mechanical loads.

1 Not included in the standard delivery.

The board **APCI-7800-3** is assembled on a 6-layer circuit.

Dimensions:



Weight: ..... approx. 150 g
Installation in: ..... 32/64-bit PCI slot
(5 V and 3.3 V)

Connection to the peripheral:
78-pin SUB-D female connector

Connection cable for the APCI-7800-3[1]
ST7809:
78-pin SUB-D male connector to 8 x 9 pin SUB-D male connector
ST075:
78-pin SUB-D male connector to 8 x 25-pin SUB-D male connector

WARNING!
The supply lines must be installed safely against mechanical loads.

[1] Not contained in the standard delivery. Please order separately.

4.3 Limit values

Max. altitude: ..... 2000 m
Operating temperature: ..... 0 to 60°C
Storage temperature: ..... -25 to 70°C
Relative humidity at indoor installation
50% at +40 °C
80% at +31 °C

Minimum PC requirements:
PCI BIOS from Version 1.0
Bus speed: ..... < 33 MHz
Operating system: ..... Windows Vista (32-bit), XP, 2000, Linux

Energy requirements:
- Operating voltage of the PC: ..... 5 V ± 5%
- Current consumption (without load): ..... typ. see table ± 10%

	APCI-7300-3	APCI-7400-3	APCI-7500-3	APCI-7800-3
+ 5 V from PC	160 mA	160 mA	160 mA	220 mA

Add to this data the current consumption of the used modules according to the following table:

	MXxxx	MXxxx-G
RS 232	10 mA	86 mA
RS 422	10 mA	46 mA
RS 485	10 mA	58 mA
20 mA	75 mA	-
MX 422-PEP[1]	-	66 mA

[1] With software handshake (RTS CTS version)

4.3.1 RS232

CCITT-recommendation: V.24
US-Norm EIA: ..... RS 232

Without optical isolation (MX232)

Max. transfer rate: ..... 1 MBaud
Transfer rate on request ..... Up to 2.5 MBaud
ESD protection ..... 15 kV

With optical isolation (MX232-G)

Max. transfer rate: ..... 1 MBaud
Transfer rate on request ..... Up to 2.5 MBaud
ESD protection ..... 15 kV
Creeping distance: ..... 3.2 mm
Test voltage: ..... 1000 VAC
Short-circuit protection

4.3.2 RS422, RS485

CCITT recommendation: V.11
US norm EIA: RS422, RS485

Without optical isolation (MX422, MX485)

Max. transfer rate: ..... 1 MBaud
Transfer rate on request ..... Up to 2.5 MBaud
ESD protection ..... 15 kV
Transorb diodes

With optical isolation (MX422-G, MX485-G)

Max. transfer rate: ..... 1 Mbaud
Transfer rate on request ..... Up to 2.5 MBaud
ESD protection ..... 15 kV
Creeping distance: ..... 3.2 mm
Test voltage: ..... 1000 VAC
Short-circuit protection

4.3.3 20mA constant current loop (MXTTY)

Max. Baud rate: ..... 19.2 kBaud
Transorb diodes: ..... 400 W
Absorption power
Creeping distance: ..... 3.2 mm
Test voltage: ..... 1000 VAC
Load: ..... 500 Ω

Voltage reversal and short-circuit protection through transorb diodes

IMPORTANT!
Basic board and 1MBd configuration (option): Please check that the quartz frequency is correctly set in ADDIREG or in the device manager of your operating system. See 6.1 for Windows XP/2000. The 1M Baud rate can only be programmed with the device drivers delivered with the board.

4.4 Component scheme and block diagrams

Fig. 4-1: Component scheme of the APCI-7300-3, APCI-7420-3 and APCI-7500-3

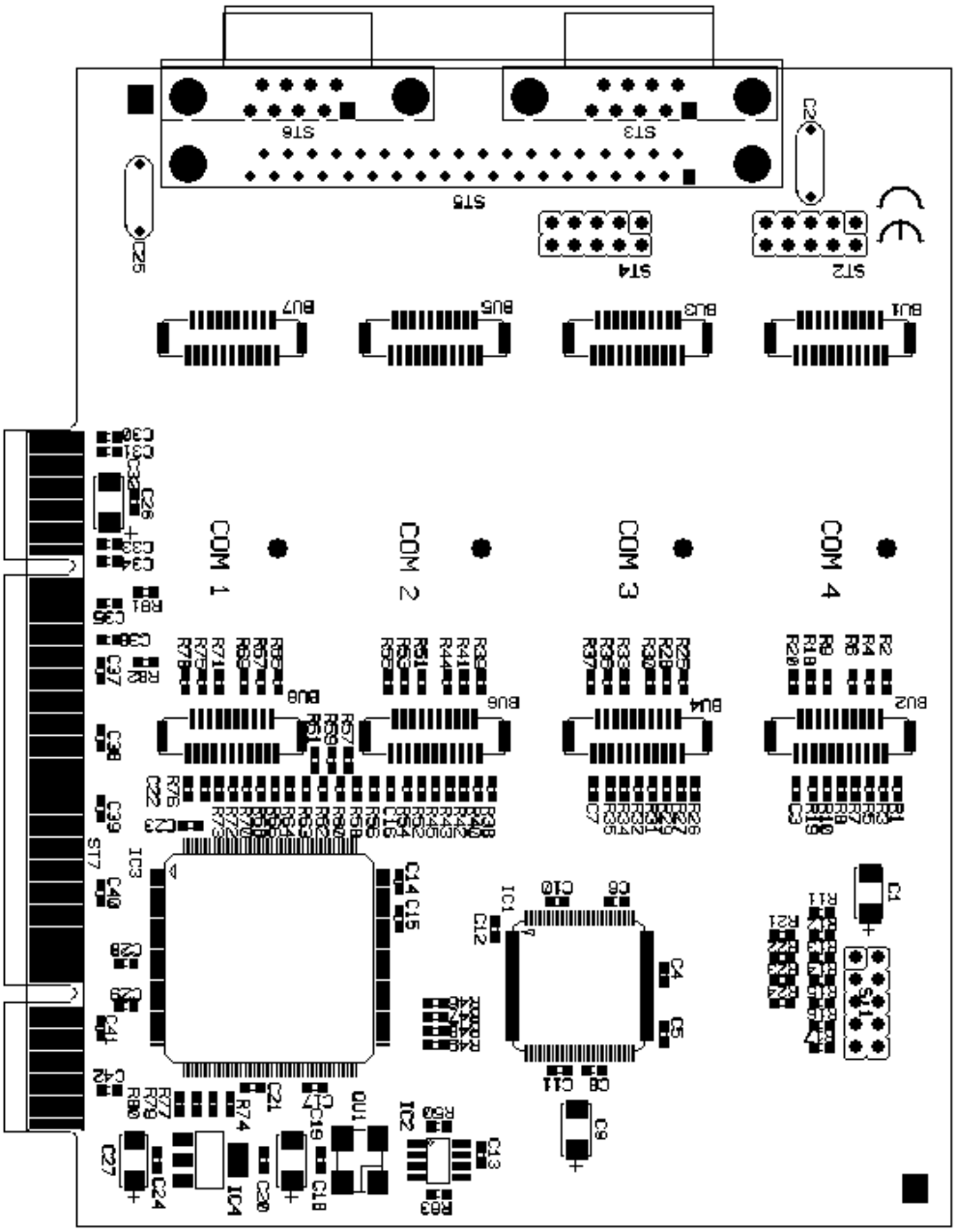


Fig. 4-2: Component scheme of the APCI-7800-3

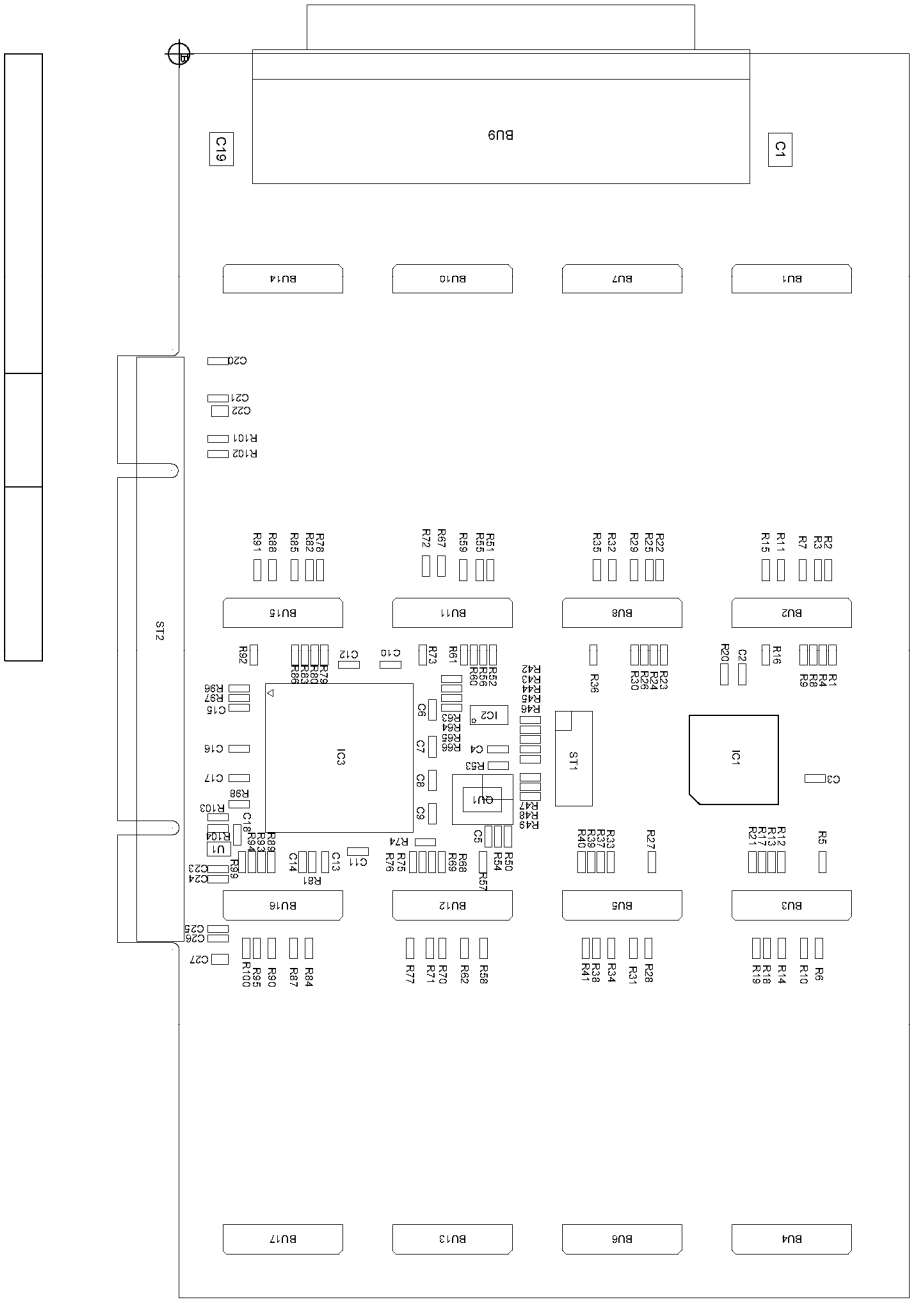


Fig. 4-3: Component scheme of the APCI-7800-3 (solder side)

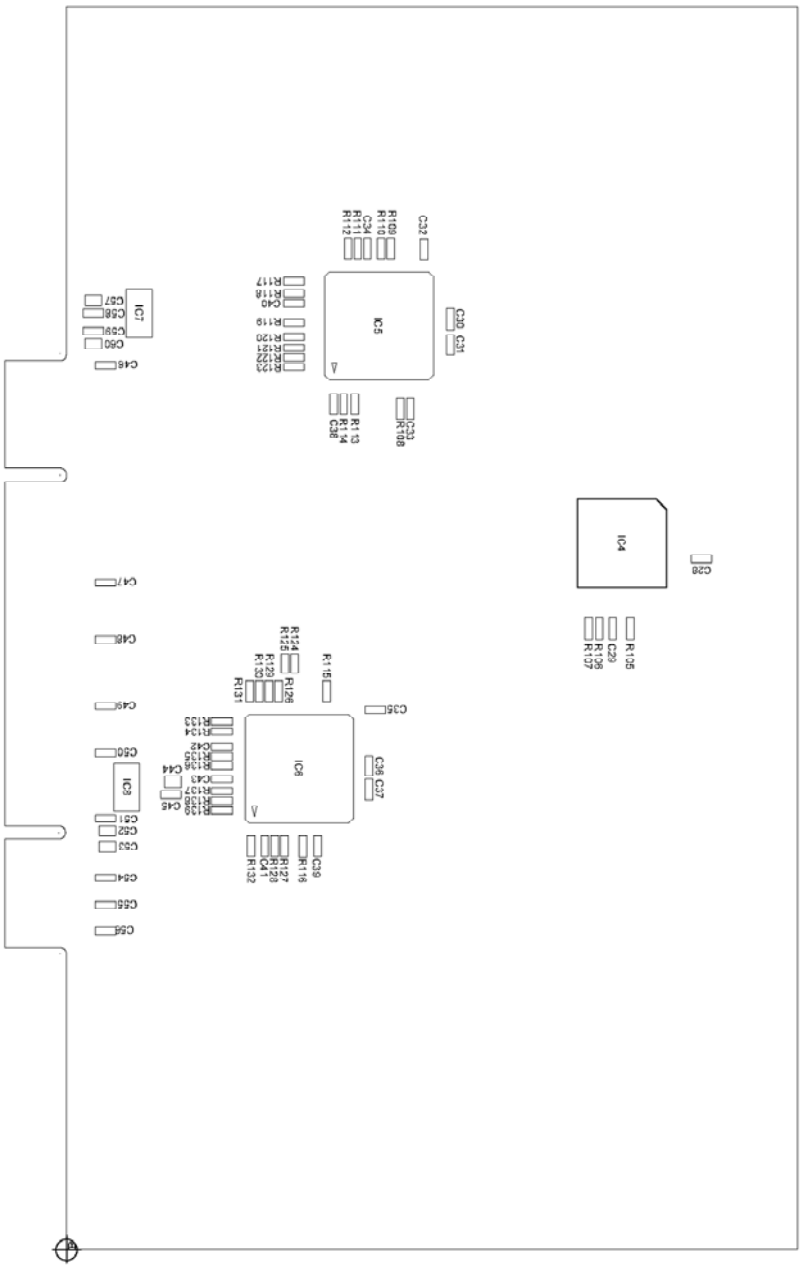


Fig. 4-4: Block diagram of the APCI-7300-3

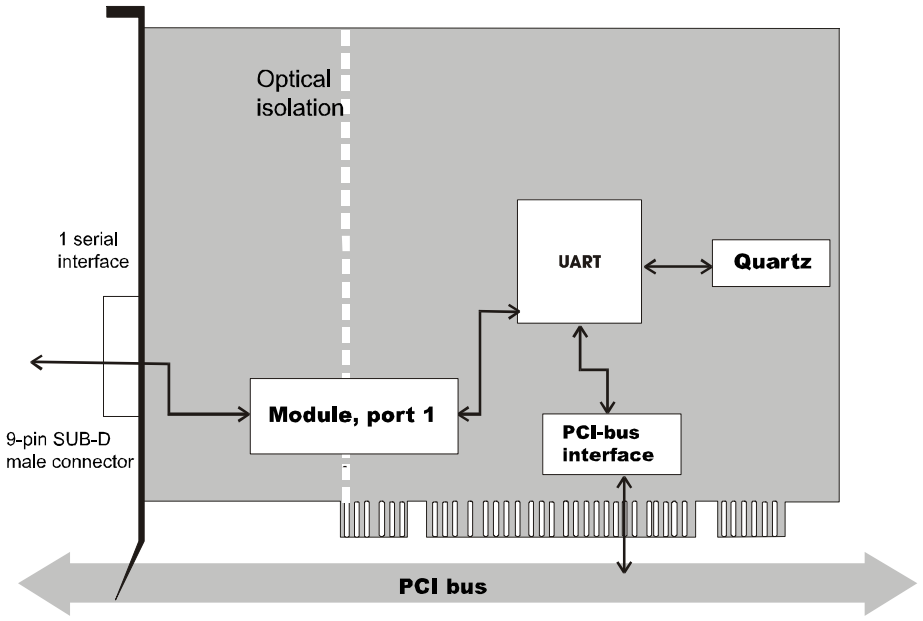


Fig. 4-5: Block diagram of the APCI-7420-3

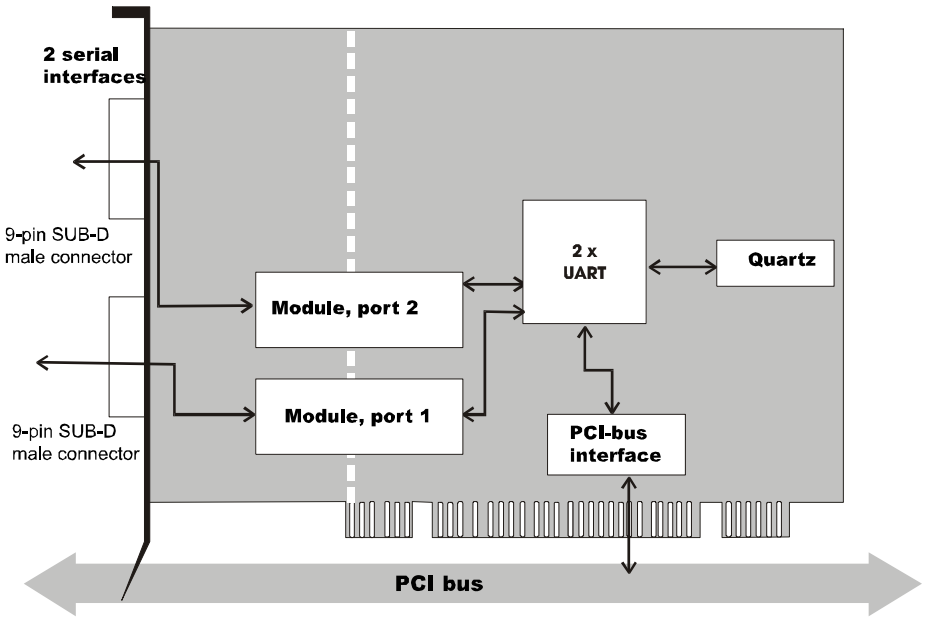


Fig. 4-6: Block diagram of the APCI-7500-3

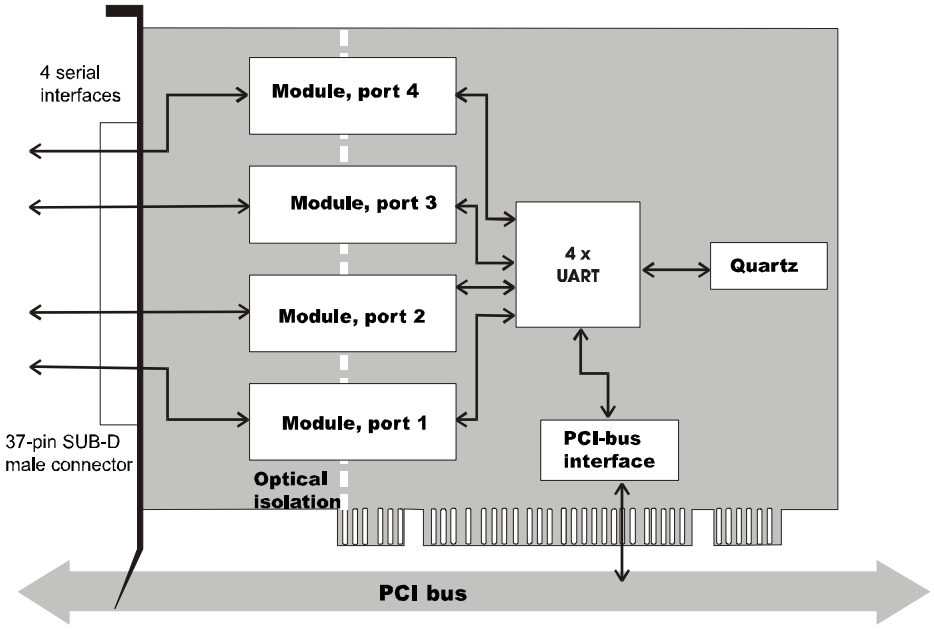


Fig. 4-7: Block diagram of the APCI-7500-3/4C

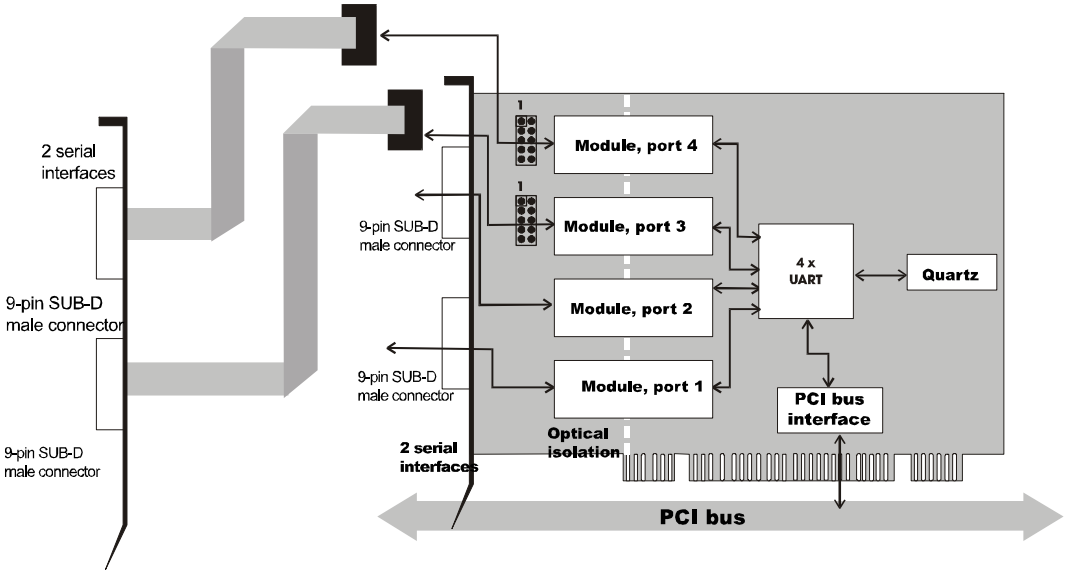
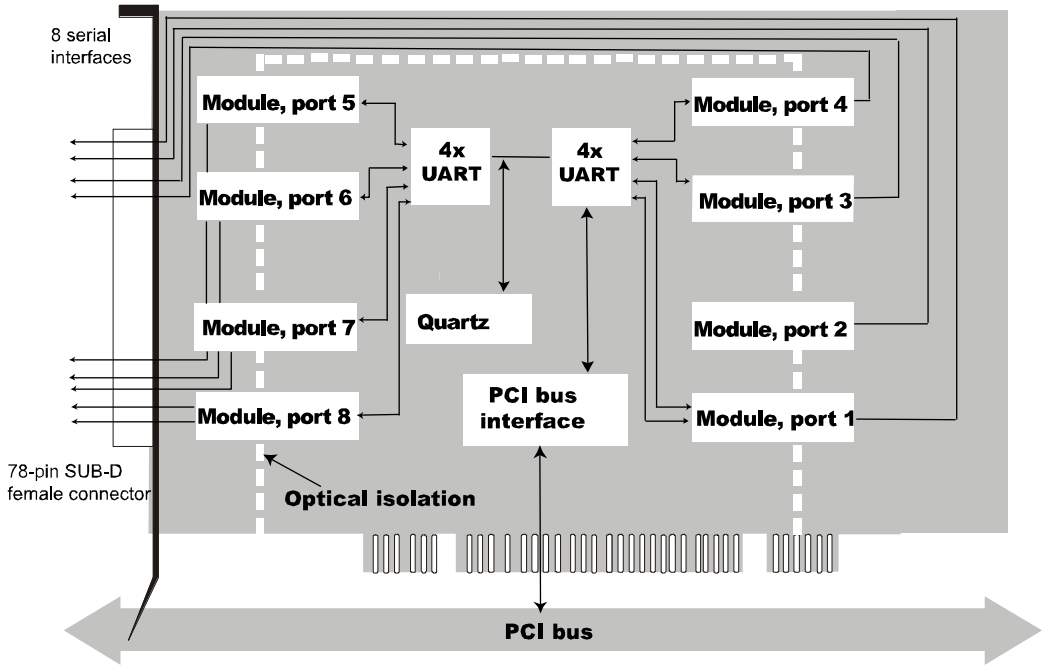


Fig. 4-8: Block diagram of the APCI-7800-3



5 INSTALLATION OF THE BOARD

The interrupt lines and base address of the board are allocated by the BIOS of the PC system through software. No setting is then required before inserting the board.

IMPORTANT!
Do observe the safety precautions (yellow leaflet)!

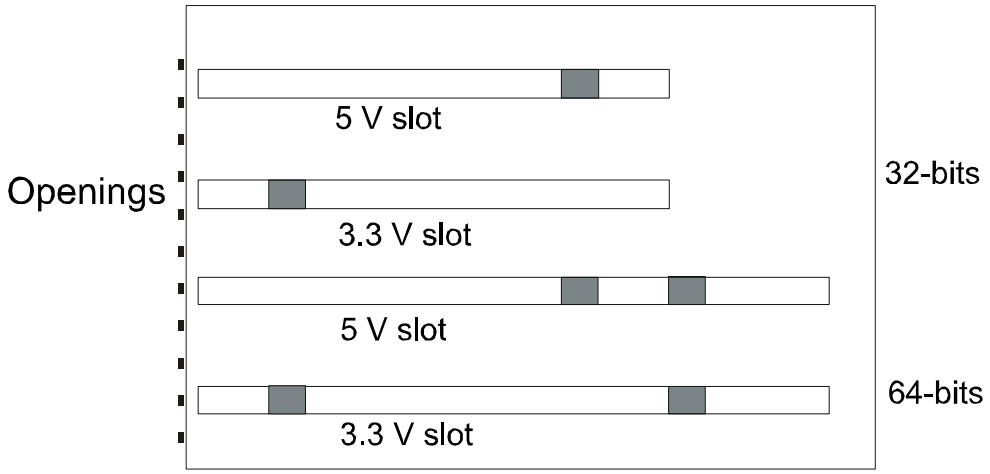
5.1 Opening the PC

- **Switch off your PC and all the units connected to the PC**
- **Pull the PC mains plug from the socket.**
- **Open your PC as described in the manual of the PC manufacturer.**

5.2 Selecting a free slot

- **Insert the board in a free PCI-5 V or 3.3 V slot (32/64-bit).**

Fig. 5-1: Slot types



- **Remove the back cover of the selected slot according to the instructions of the PC manufacturer.**

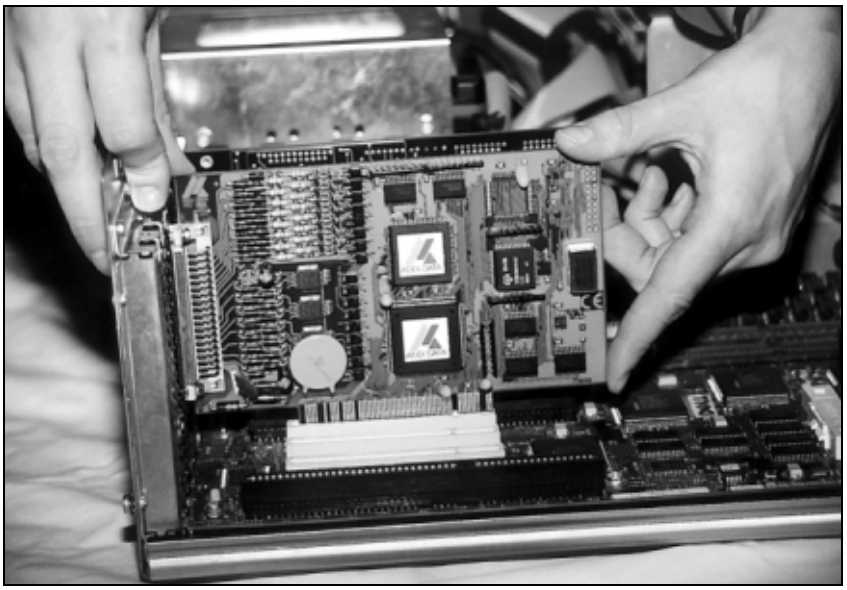
Keep the back cover. You will need it if you remove the board

- **Discharge yourself from electrostatic charges.**
- **Take the board out of its protective pack.**

5.3 Plugging the board into the slot

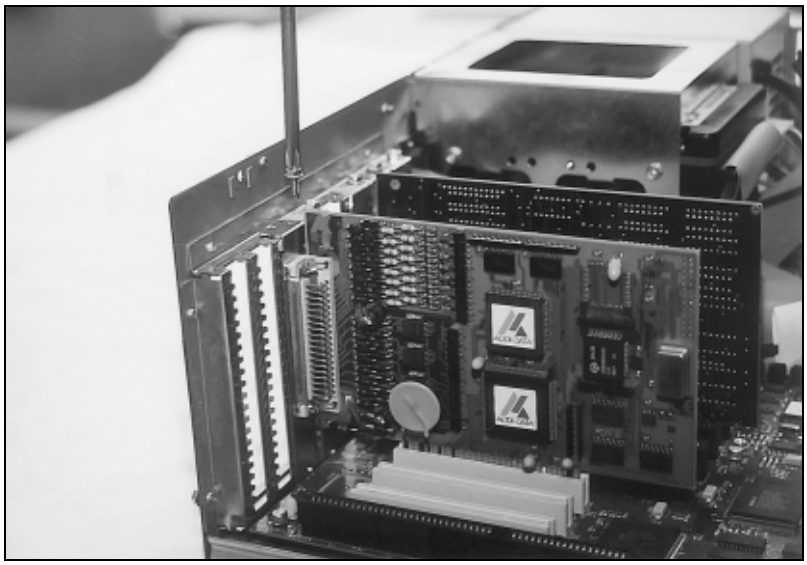
♦ Insert the board **vertically into the chosen slot.**

Fig. 5-2: Inserting the board



♦ Fasten the board **to the rear of the PC housing with the screw which was fixed on the back cover.**

Fig. 5-3: Fastening the board at the back cover



♦ **Tighten all the loosen screws.**

5.4 Closing the PC

♦ **Close your PC as described in the manual of the PC manufacturer.**

6 BOARD CONFIGURATION

In this chapter you will find a description of the delivered software and its possible applications.

IMPORTANT!
Further information for installing and uninstalling the different drivers is to be found in the delivered description
"Installation instructions for the PCI and ISA bus".

A link to the corresponding PDF file is available in the navigation pane (Bookmarks) of Acrobat Reader.

The board is supplied with a driver CD-ROM (CD1) containing:
- ADDICOM software samples with API function for the ADDI-DATA boards in 32-bits

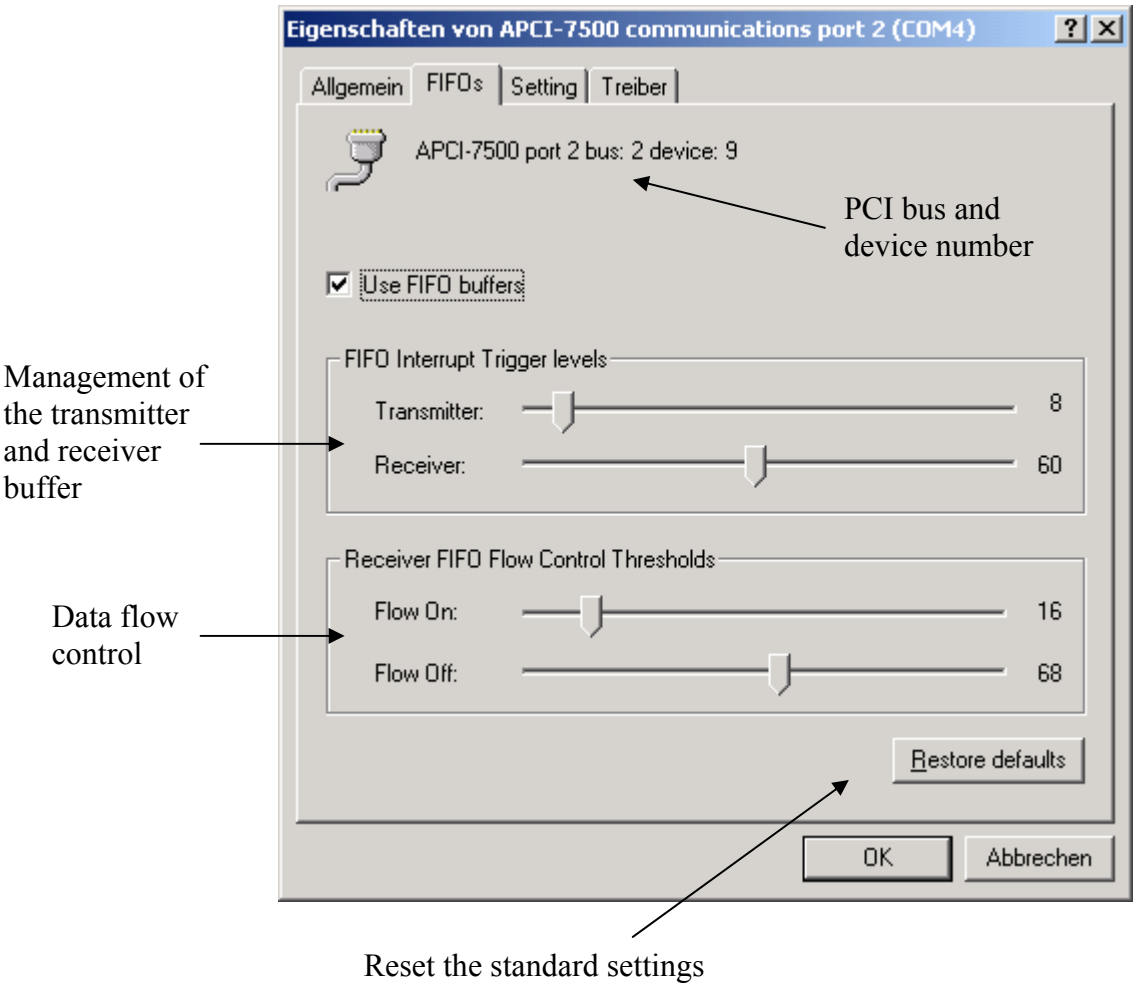
6.1 Configuration under Windows XP/2000/95/98/ Server 2003

In the Windows device manager you can set the different interfaces according to your requirements through double click.

Start the device manager of your operating system under Start/(Settings)/Control panel/System

In the "FIFO" register the following settings are possible:

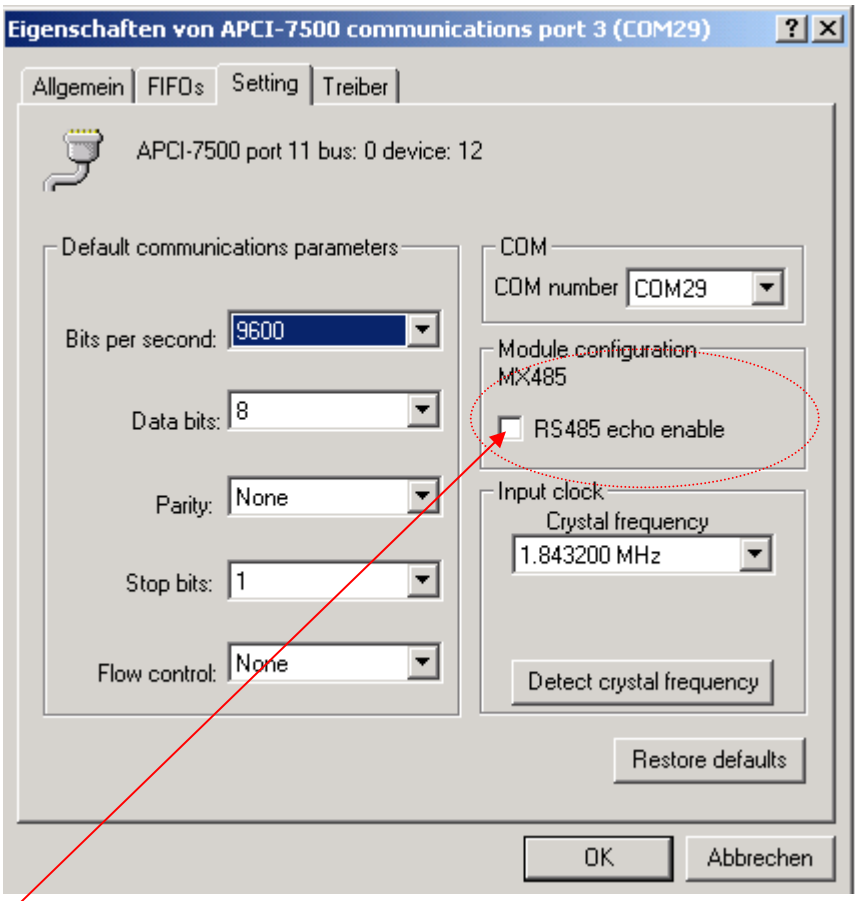
Fig. 6-1: FIFO settings under Windows 2000*



* The example shows the settings under Windows 2000

Under "Setting" you adapt the operating mode to the used interface.

Fig. 6-2: Setting example: RS485*



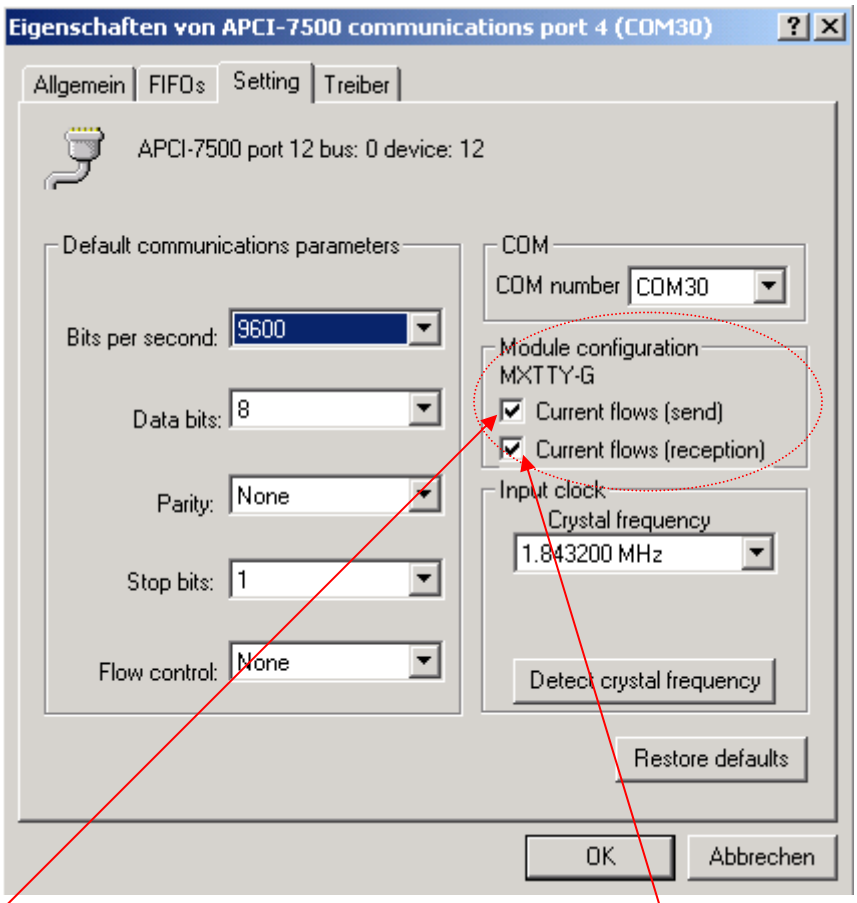
RS 485 echo enable: For the control of the receiver at RS485 half duplex communication:

Checked ☑:During sending of data of the board to the peripheral, the receiver of the board is released.

Not checked ☐: During sending of data of the board to the peripheral, the receiver of the board is blocked.

* The example shows the settings under Windows 2000

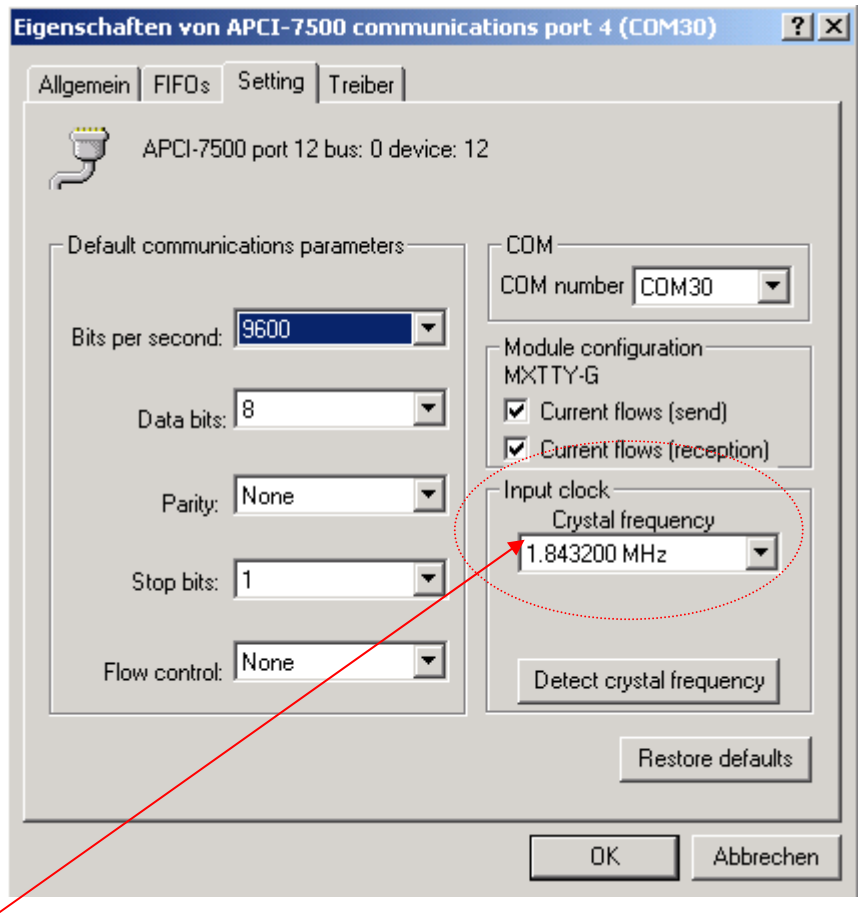
Fig. 6-3: Setting example: MXTTY current loop: Module configuration*



Current flows (send): Definition of the current flow in the transmitting current loop, i.e. the non-operative connection of the board APCI-7xxx-3 (sender) to the peripheral device (receiver) (no serial data flow): Checked ☑: Current flows Not checked ☐: No current flows	**Current flows (reception):** Definition of the current flow in the receiving current loop, i.e. the non-operative connection of the board APCI-7xxx-3 (receiver) to the peripheral device (sender) (no data flow): Checked ☑: Current flows Not checked ☐: No current flows

* The example shows the settings under Windows 2000

Fig. 6-4: Setting example: MXTTY current loop: Input clock*



Input clock:
Under ”Crystal frequency“ the frequency of the integrated quartz oscillator of the board is indicated. The standard PC quartz crystal frequency is 1.8432 MHz, so that the max. baud rate that can be set is 115200.

6.2 Board test

You can test if you board is not correctly installed with a shorting plug and the test software MTTTY.

The setup file for the test software MTTTY is supplied on the CD-ROM under CD/MMTTY. The program is described in chapter 7.7.3.

* The example shows the settings under Windows 2000

6.3 Questions and software downloads on the web

Do not hesitate to e-mail us your questions.
per e-mail: info@addi-data.de

Free downloads of standard software

You can download the latest version of the software for the board **APCI-7xxx-3**

http://www.addi-data.com.

IMPORTANT!
Before using the board or in case of malfunction during operation, check if there is an update of the product (technical description, driver). The current version can be found on the internet or contact us directly.

7 CONNECTING THE PERIPHERAL

IMPORTANT!
The connector pin assignments are valid for the boards **APCI-7300-3**, **APCI-7420-3** and **APCI-7500-3** from **Revision D** and for the **APCI-7800-3** from **Revision C** of the printed circuit board. At revisions before the DCD/DSR modem control signals at RS232 are changed.

7.1 Connector pin assignment: APCI-7500-3

Fig. 7-1: 37-pin SUB-D male connector (of the board)

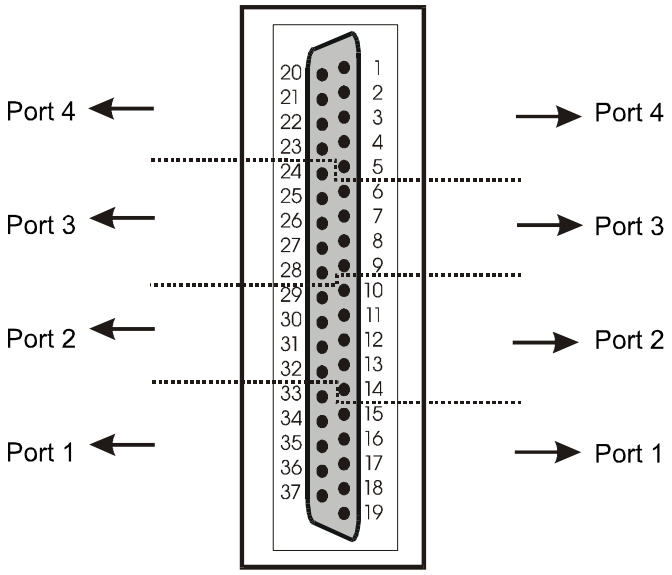


Table 7-1: Pin assignment of the 37-pin connector

RS485	RS422	Current Loop	RS232	Pin	Pin	RS232	Current Loop	RS422	RS485	
120 Ω	100 Ω		DSR	20	1	DCD	+XMIT-CL-DATA	TA		
		Tsource	RTS	21	2	RxD	-XMIT-CL-DATA	TB		Port 4
		Rsource	CTS	22	3	TxD	+RCV-CL-DATA	RA	Tx/Rx+	
Tx/Rx-	RB	-RCV-CL-DATA	RI	23	4	DTR		Rab (1)		
	TA	+XMIT-CL-DATA	DCD	24	5	GND	GND	GND	GND	
	TB	-XMIT-CL-DATA	RxD	25	6	DSR		100 Ω	120 Ω	
Tx/Rx+	RA	+RCV-CL-DATA	TxD	26	7	RTS	Tsource			Port 3
Rab (1)			DTR	27	8	CTS	Rsource			
GND	GND	GND	GND	28	9	RI	-RCV-CL-DATA	RB	Tx/Rx-	
120 Ω	100 Ω		DSR	29	10	DCD	+XMIT-CL-DATA	TA		
		Tsource	RTS	30	11	RxD	-XMIT-CL-DATA	TB		Port 2
		Rsource	CTS	31	12	TxD	+RCV-CL-DATA	RA	Tx/Rx+	
Tx/Rx-	RB	-RCV-CL-DATA	RI	32	13	DTR		Rab (1)		
	TA	+XMIT-CL-DATA	DCD	33	14	GND	GND	GND	GND	
	TB	-XMIT-CL-DATA	RxD	34	15	DSR		100 Ω	120 Ω	
Tx/Rx+	RA	+RCV-CL-DATA	TxD	35	16	RTS	Tsource			Port 1
Rab (1)			DTR	36	17	CTS	Rsource			
GND	GND	GND	GND	37	18	RI	-RCV-CL-DATA	RB	Tx/Rx-	
					19					

TA: Tx422+ RA: Rx422+
TB: Tx422- RB: Rx422-
Rab: Connection to a terminal resistor
(1): Cable connection to 100 Ω/120 Ω terminates the RS422/RS485 lines with the 100 Ω/120 Ω resistor.

7.2 Pin assignment: APCI-7420-3, APCI-7300-3 and APCI-7500-3(/4C)

Fig. 7-2: 9-pin SUB-D male connector

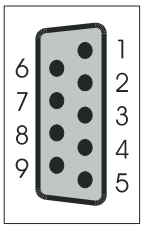


Table 7-2: Pin assignment of the 9-pin connector

RS485	RS422	Current Loop	RS232	Pin	Pin	RS232	Current Loop	RS422	RS485
120 Ω	100 Ω		DSR	6	1	DCD	+XMIT-CL-DATA	TA	
		Tsource	RTS	7	2	RxD	-XMIT-CL-DATA	TB	
		Rsource	CTS	8	3	TxD	+RCV-CL-DATA	RA	Tx/Rx+
Tx/Rx-	RB	-RCV-CL-DATA	RI	9	4	DTR		Rab (1)	
					5	GND	GND	GND	GND

TA: Tx422+ RA: Rx422+
TB: Tx422- RB: Rx422-
Rab: Connection to a terminal resistor
(1): Cable connection to 100 Ω/120 Ω terminates the RS422/RS485 lines with the 100 Ω/120 Ω resistor.

7.3 Pin assignment: APCI-7800-3

Fig. 7-3: 78-pin SUB-D female connector (of the board)

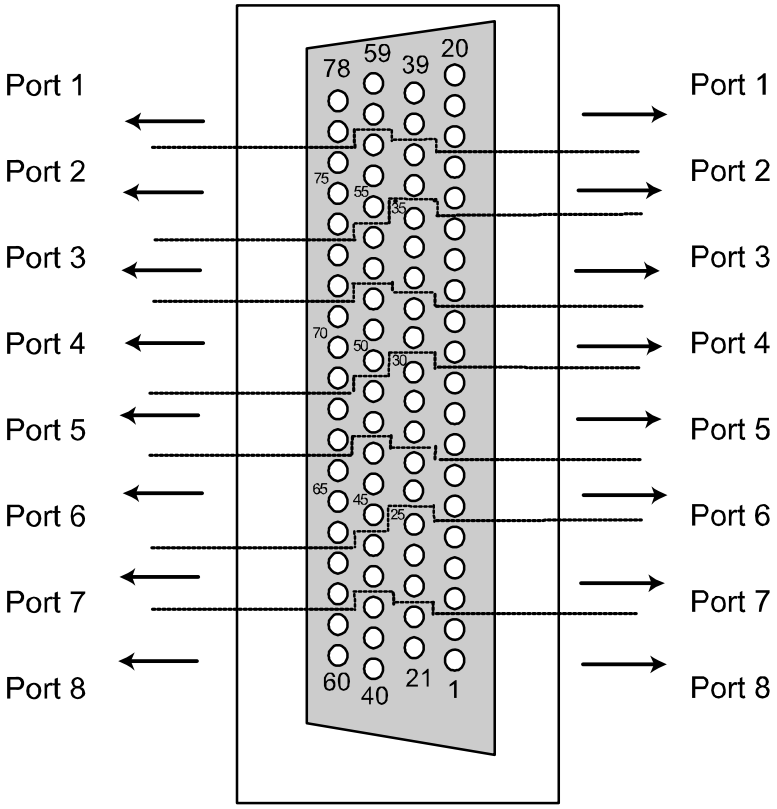


Table 7-3: Pin assignment of port 1

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
20	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
19	RxD	TB		Tx-	-XMIT-CL-DATA
18	GND			GND	GND
39	RTS			RTS-	Tsource
38	CTS			RTS+	Rsource
59	DCD	TA		Tx+	+XMIT-CL-DATA
58	DSR	100 Ω	120 Ω	CTS+	
78	DTR	Rab		CTS-	
77	RI	RB	Tx / Rx -	RX-	-RCV-CL-DATA

Table 7-4: Pin assignment of port 2

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
75	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
76	RxD	TB		Tx-	-XMIT-CL-DATA
57	-				
74	GND			GND	GND
56	RTS			RTS-	Tsource
55	CTS			RTS+	Rsource
37	DCD	TA		Tx+	+XMIT-CL-DATA
36	DSR	100 Ω	120 Ω	CTS+	
17	DTR	Rab		CTS-	
16	RI	RB	Tx / Rx -	RX-	-RCV-CL-DATA

Table 7-5: Pin assignment of port 3

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
14	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
15	RxD	TB		Tx-	-XMIT-CL-DATA
35	-				
13	GND			GND	GND
34	RTS			RTS-	Tsource
33	CTS			RTS+	Rsource
54	DCD	TA		Tx+	+XMIT-CL-DATA
53	DSR	100 Ω	120 Ω	CTS+	
73	DTR	Rab		CTS-	
72	RI	RB	Tx / Rx -	RX-	-RCV-CL-DATA

Table 7-6: Pin assignment of port 4

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
70	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
71	RxD	TB		Tx-	-XMIT-CL-DATA
69	GND			GND	GND
52	-				
51	RTS			RTS-	Tsource
50	CTS			RTS+	Rsource
32	DCD	TA		Tx+	+XMIT-CL-DATA
31	DSR	100 Ω	120 Ω	CTS+	
12	DTR	Rab		CTS-	
11	RI	RB	Tx / Rx -	RX-	-RCV-CL-DATA

Table 7-7: Pin assignment of port 5

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
9	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
10	RxD	TB		Tx-	-XMIT-CL-DATA
8	GND			GND	GND
30	-				
29	RTS			RTS-	Tsource
28	CTS			RTS+	Rsource
49	DCD	TA		Tx+	+XMIT-CL-DATA
48	DSR	100 Ω	120 Ω	CTS+	
68	DTR	Rab		CTS-	
67	RI	RB	Tx / Rx -	RX-	-RCV-CL-DATA

Table 7-8: Pin assignment of port 6

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
65	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
66	RxD	TB		Tx-	-XMIT-CL-DATA
64	GND			GND	GND
47	-				
46	RTS			RTS-	Tsource
45	CTS			RTS+	Rsource
27	DCD	TA		Tx+	+XMIT-CL-DATA
26	DSR	100 Ω	120 Ω	CTS+	
7	DTR	Rab		CTS-	
6	RI	RB	Tx / Rx -	RX-	-RCV-CL-DATA

Table 7-9: Pin assignment of port 7

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
4	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
5	RxD	TB		Tx-	-XMIT-CL-DATA
3	GND			GND	GND
25	-				
24	RTS			RTS-	Tsource
23	CTS			RTS+	Rsource
44	DCD	TA		Tx+	+XMIT-CL-DATA
43	DSR	100 Ω	120 Ω	CTS+	
63	DTR	Rab		CTS-	CTS-
62	RI	RB	Tx / Rx -	RTS-	-RCV-CL-DATA

Table 7-10: Pin assignment of port 8

Pin	RS 232	RS 422	RS 485	RS422PEP	Current Loop
60	TxD	RA	Tx / Rx +	Rx+	+RCV-CL-DATA
61	RxD	TB		Tx-	-XMIT-CL-DATA
40	GND			GND	
42	RTS			RTS-	Tsource
41	CTS			RTS+	Rsource
22	DCD	TA		Tx+	+XMIT-CL-DATA
21	DSR	Rab		CTS+	CTS+
2	DTR	100 Ω	120 Ω	CTS-	
1	RI	RB	Tx / Rx -	RX-	-RCV-CL-DATA

TA: Tx422+ RA: Rx422+
TB: Tx422- RB: Rx422-
Rab: Connection to the terminal resistor
(1): Cable connection to 100 Ω/120 Ω terminates the lines RS422/RS485 with the resistor 100 Ω/120 Ω.

7.4 Pin assignments (APCI-7500-3): RS422 with handshake signals

With the module MX422-PEP you can use the modem control signals RTS and CTS.

Table 7-11: Pin assignment of the 37-pin connector: RS422 with handshake signals

	RS422	Pin	Pin	RS422	
	IA	20	1	TA	
Port 4	CB	21	2	TB	Port 4
	CA	22	3	RA	
	RB	23	4	IB	
	TA	24	5	GND	
	TB	25	6	IA	
Port 3	RA	26	7	CB	Port 3
	IB	27	8	CA	
	GND	28	9	RB	
	IA	29	10	TA	
Port 2	CB	30	11	TB	Port 2
	CA	31	12	RA	
	RB	32	13	IB	
	TA	33	14	GND	
	TB	34	15	IA	
Port 1	RA	35	16	CB	Port 1
	IB	36	17	CA	
	GND	37	18	RB	
			19		

TA: Tx422+ RA: Rx422+
TB: Tx422- RB: Rx422-

IA: CTS+ CA: RTS+
IB: CTS- CB: RTS-

7.5 Pin assignments (APCI-7420-3 and APCI-7300-3): RS422 with handshake signals

Table 7-12: Pin assignment of the 9-pin connector: RS422 with handshake signals

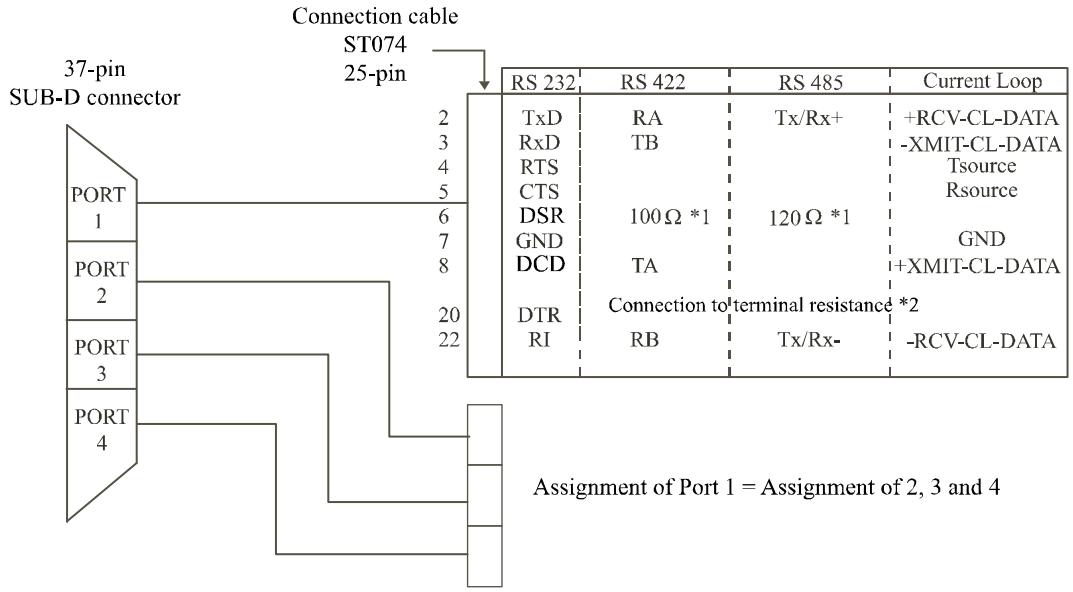
RS422	Pin	Pin	RS422
IA	6	1	TA
CB	7	2	TB
CA	8	3	RA
RB	9	4	IB
		5	GND

TA: Tx422+ RA: Rx422+
TB: Tx422- RB: Rx422-

IA: CTS+ CA: RTS+
IB: CTS- CB: RTS-

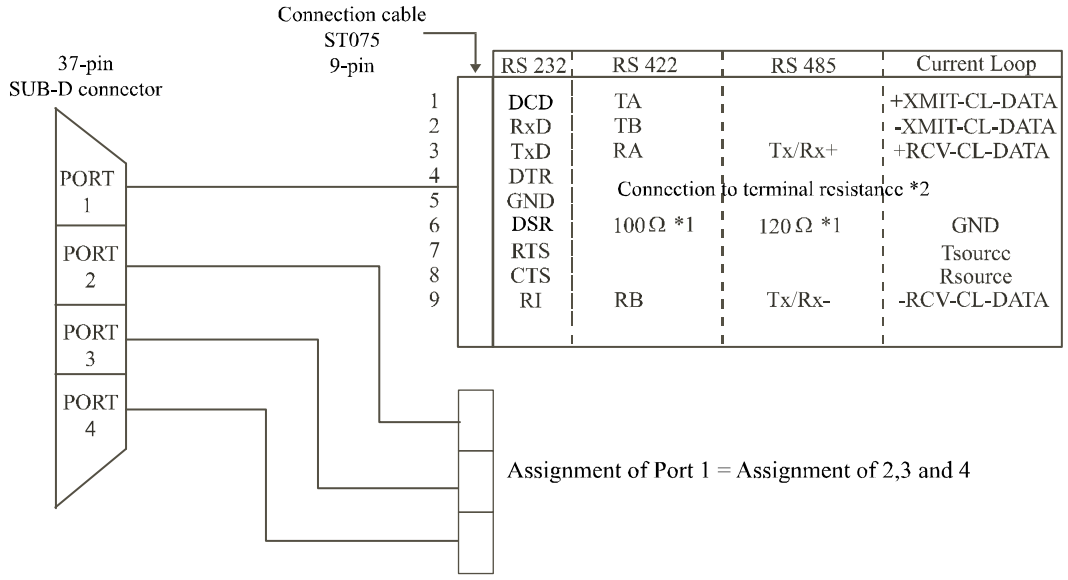
7.6 Connection cable – APCI-7500-3

Fig. 7-4: Connection cable ST074 (4 x 25-pin)



*1 Resistor integrated on the MX module
*2 Cable connection to 100 Ω/120 Ω terminates the RS422/RS485 lines with 100 Ω/120 Ω resistor. (Wire bridges between pin 20 and 6)

Fig. 7-5: Connection cable ST075 (4 x 9-pin)



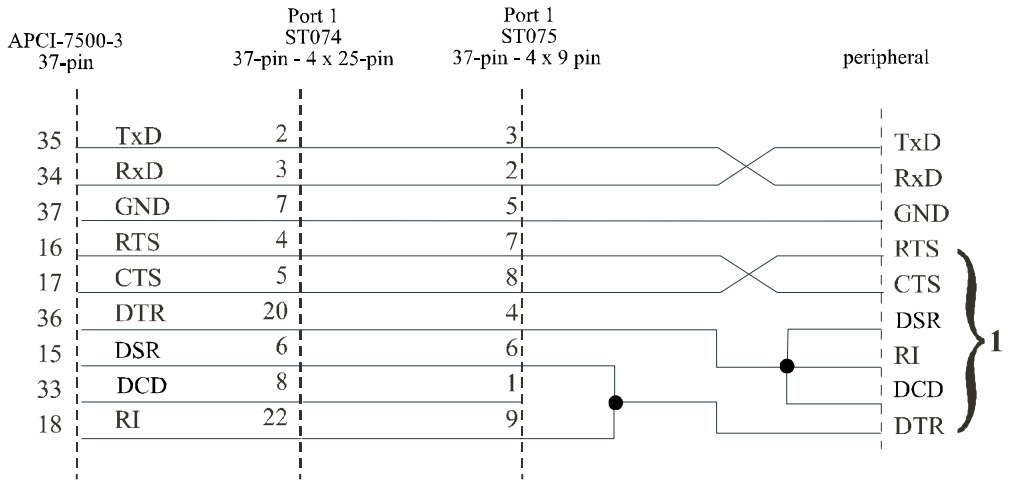
*1 Resistor integrated on the MX module
*2 Cable connection to 100 Ω/120 Ω terminates the RS422/RS485 lines with 100 Ω/120 Ω resistor. (Wire bridges between pin 4 and pin 6).

7.7 Connection examples

7.7.1 APCI-7500-3

RS232 cabling

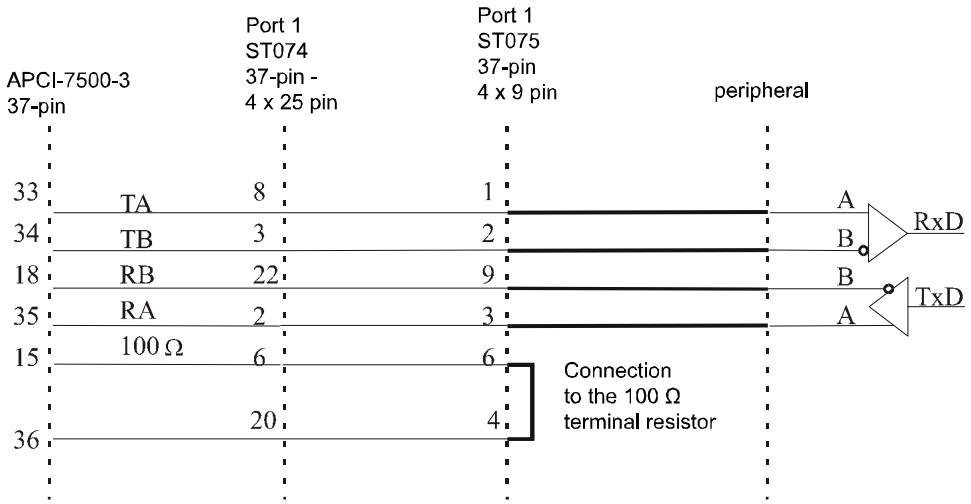
Fig. 7-6: RS232 cabling - 4-port interface



1 If the modem control signals are not used, they must be bridged externally via a jumper.

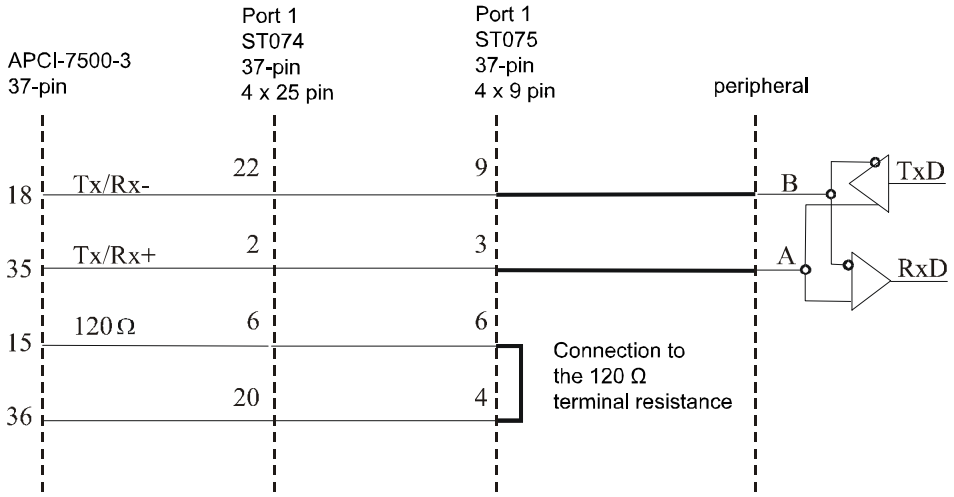
RS422 cabling

Fig. 7-7: RS422 cabling - 4-port interface



RS485 cabling

Fig. 7-8: RS485 cabling - 4-port interface



Current loop (20 mA) cabling

Active/passive: When a transmitter and a receiver communicate, one of them has to supply the necessary current. If the transmitter supplies the current, it is active. The receiver is passive. In reverse, if the receiver supplies the current, it is active.

Fig. 7-9: Active transmission/active reception 4-port serial interface

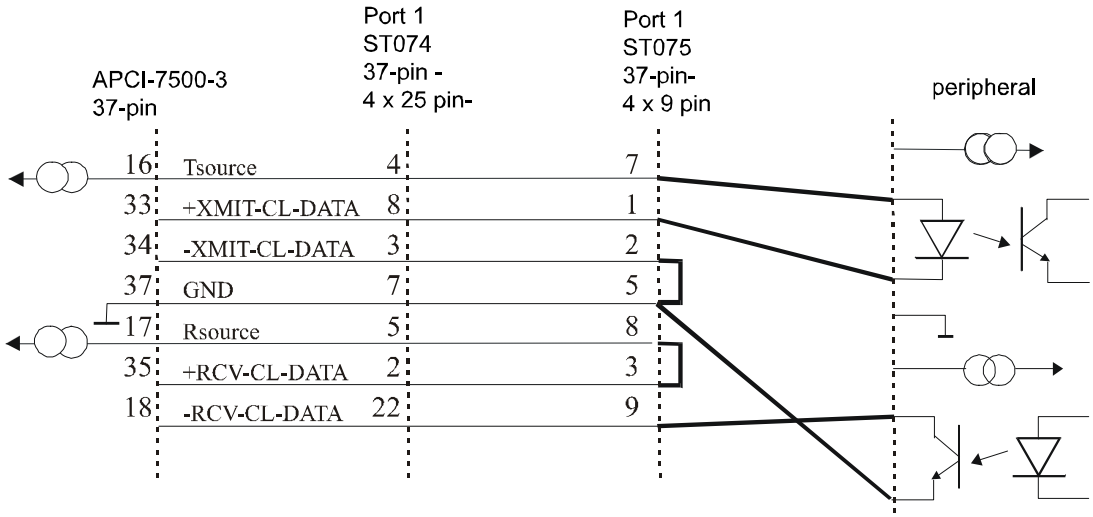


Fig. 7-10: Active transmission/passive reception 4-port serial interface

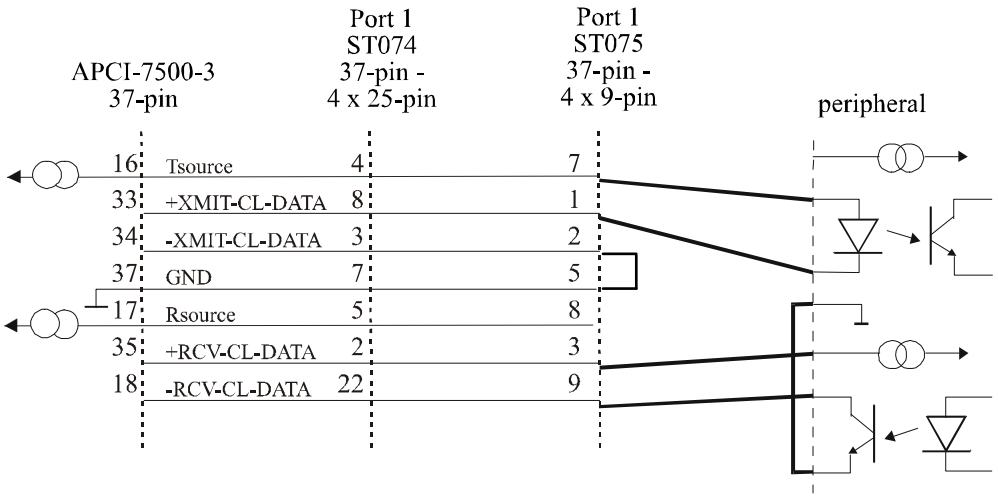


Fig. 7-11: Passive transmission/active reception 4-port serial interface

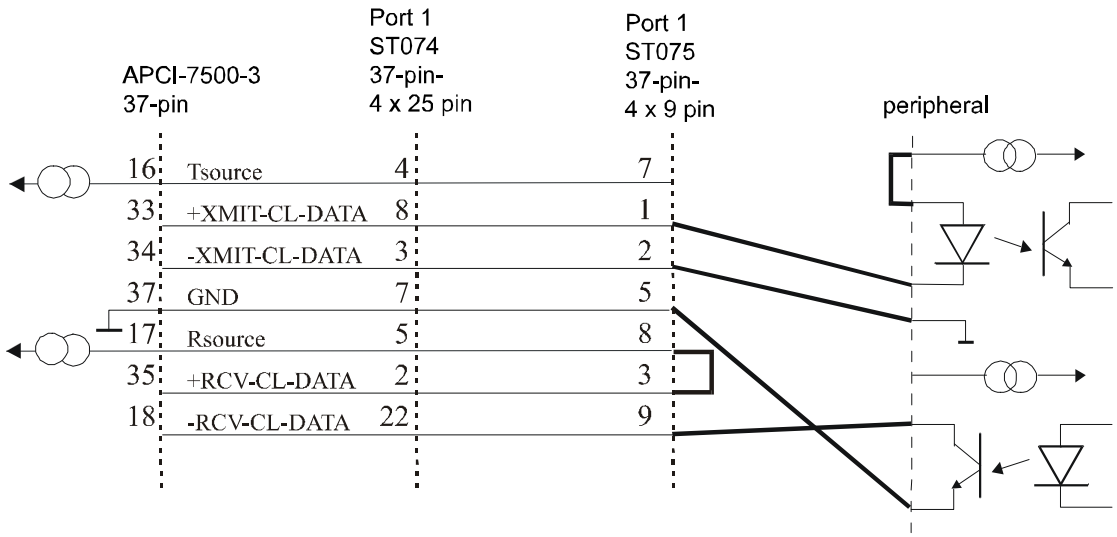
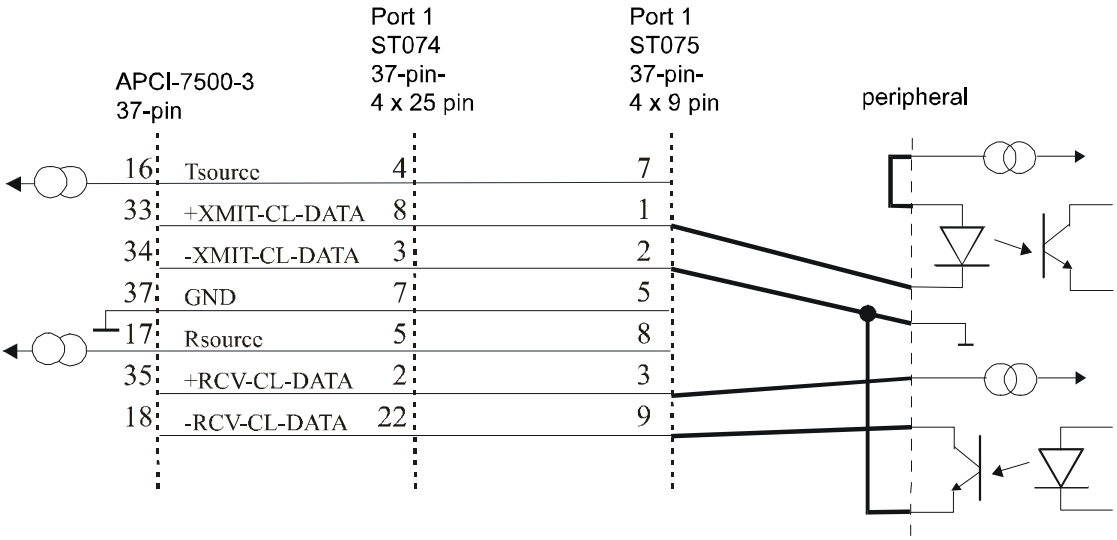


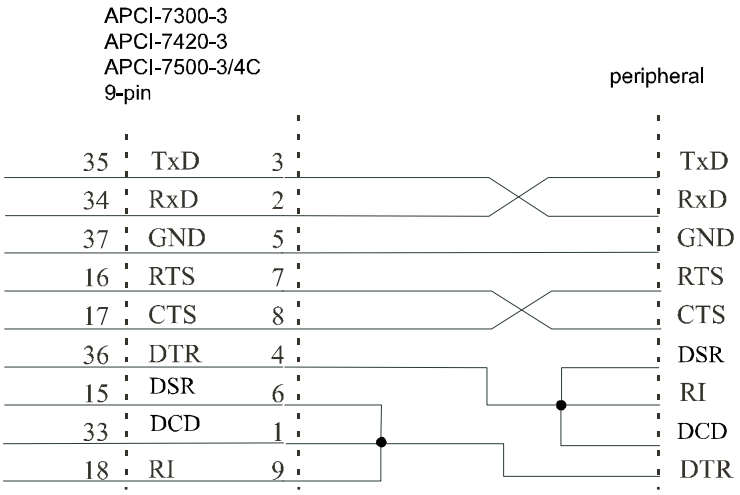
Fig. 7-12: Passive transmission/passive reception 4-port serial interface



7.7.2 APCI-7300-3, APCI-7420-3, APCI-7500-3/4C

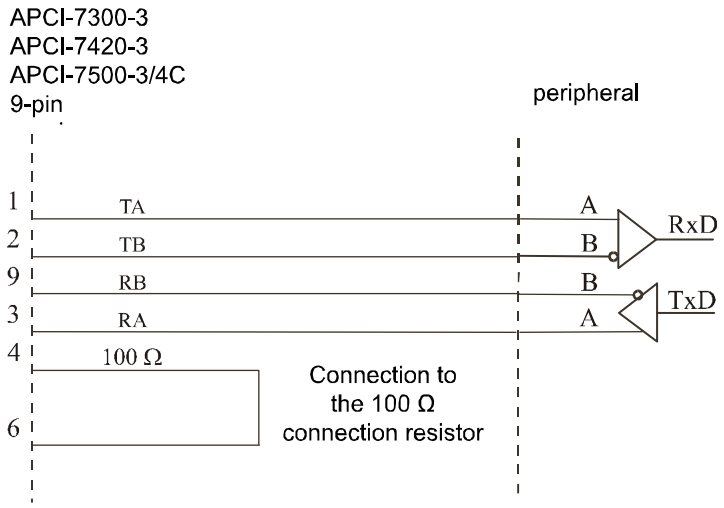
RS232 cabling

Fig. 7-13: RS232 cabling - 9-pin connector



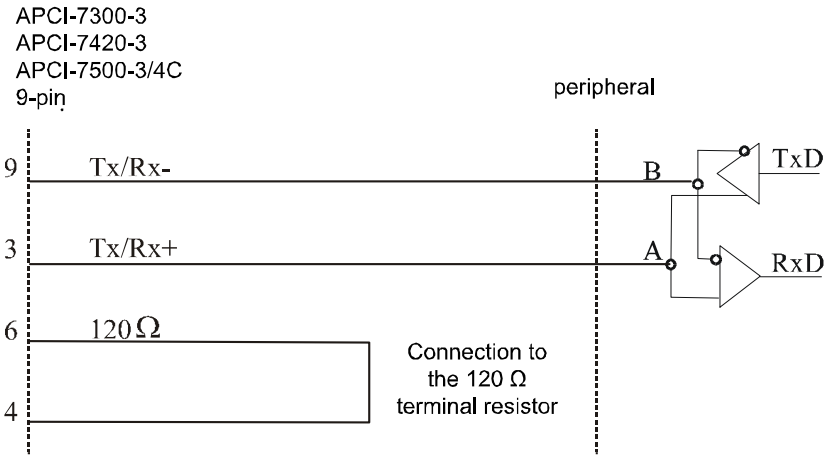
RS422 cabling

Fig. 7-14: RS422 cabling - 9-pin connector



RS485 cabling

Fig. 7-15: RS485 cabling - 9-pin connector



Current loop (20 mA) cabling

Fig. 7-16: Active transmission/active reception 9-pin connector

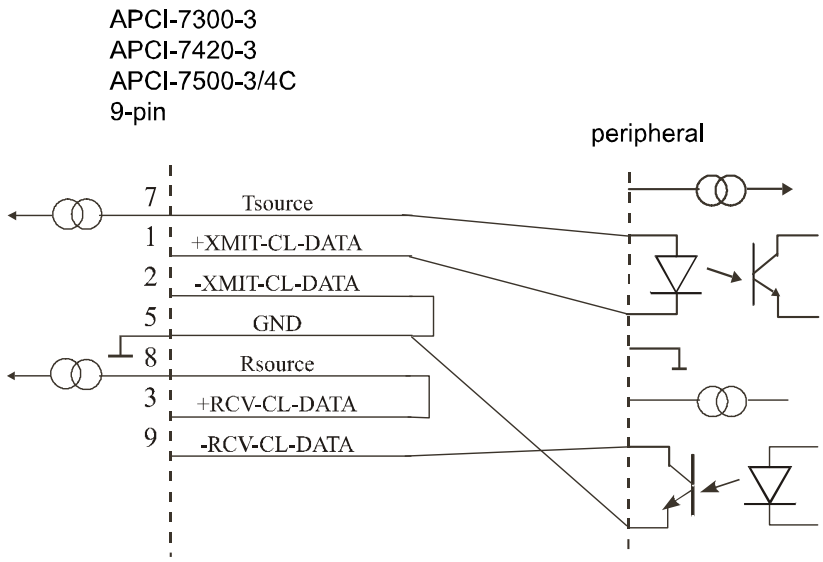


Fig. 7-17: Active transmission/passive reception 9-pin connector

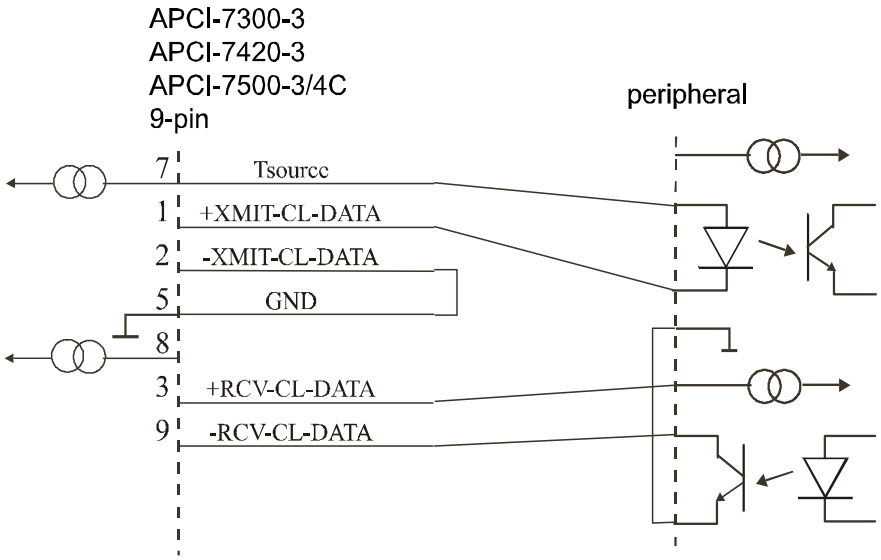


Fig. 7-18: Passive transmission/active reception 9-pin connector

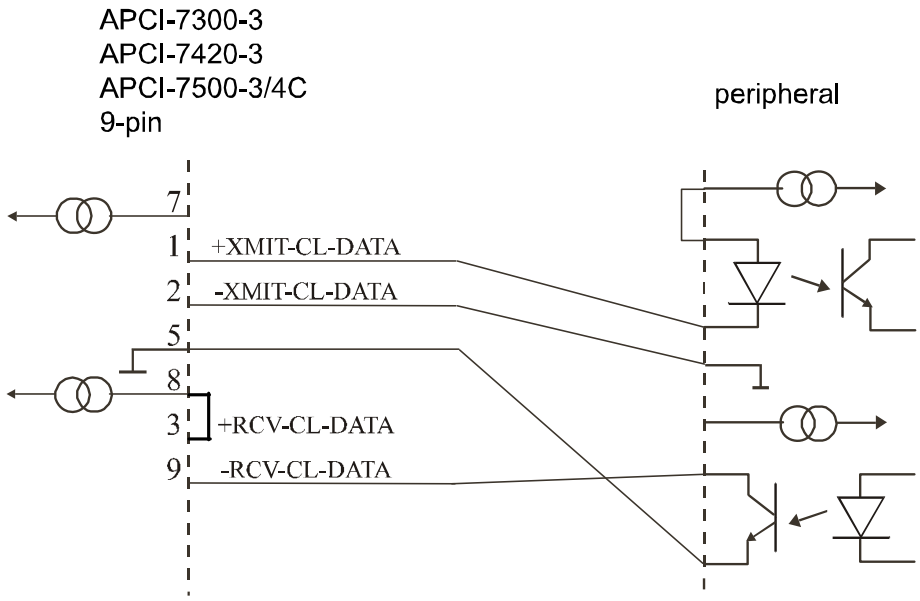
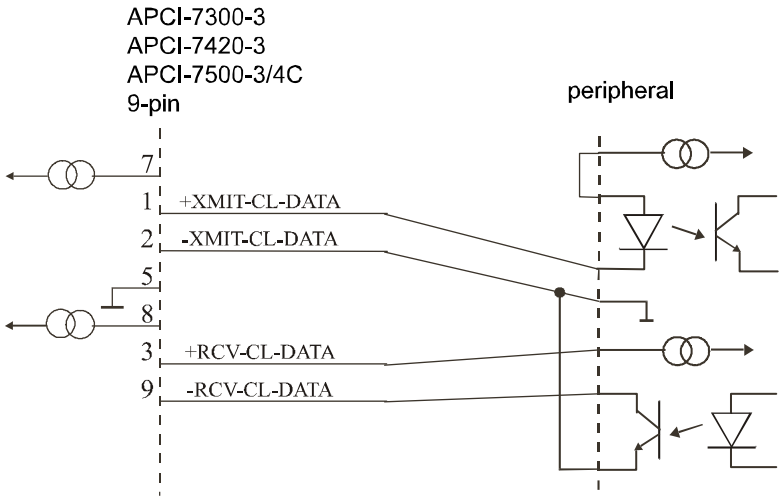


Fig. 7-19: Passive transmission/passive reception 9-pin connector



7.7.3 APCI-7800-3

Fig. 7-20: Connection cable ST7809 (8 x 9 pin)

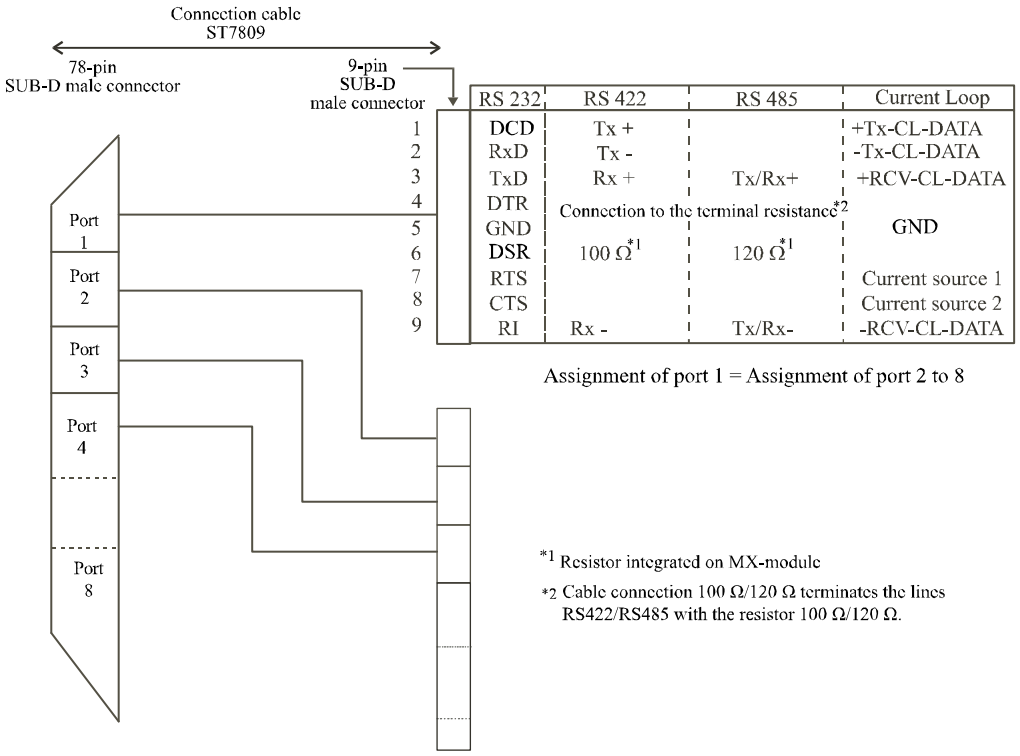
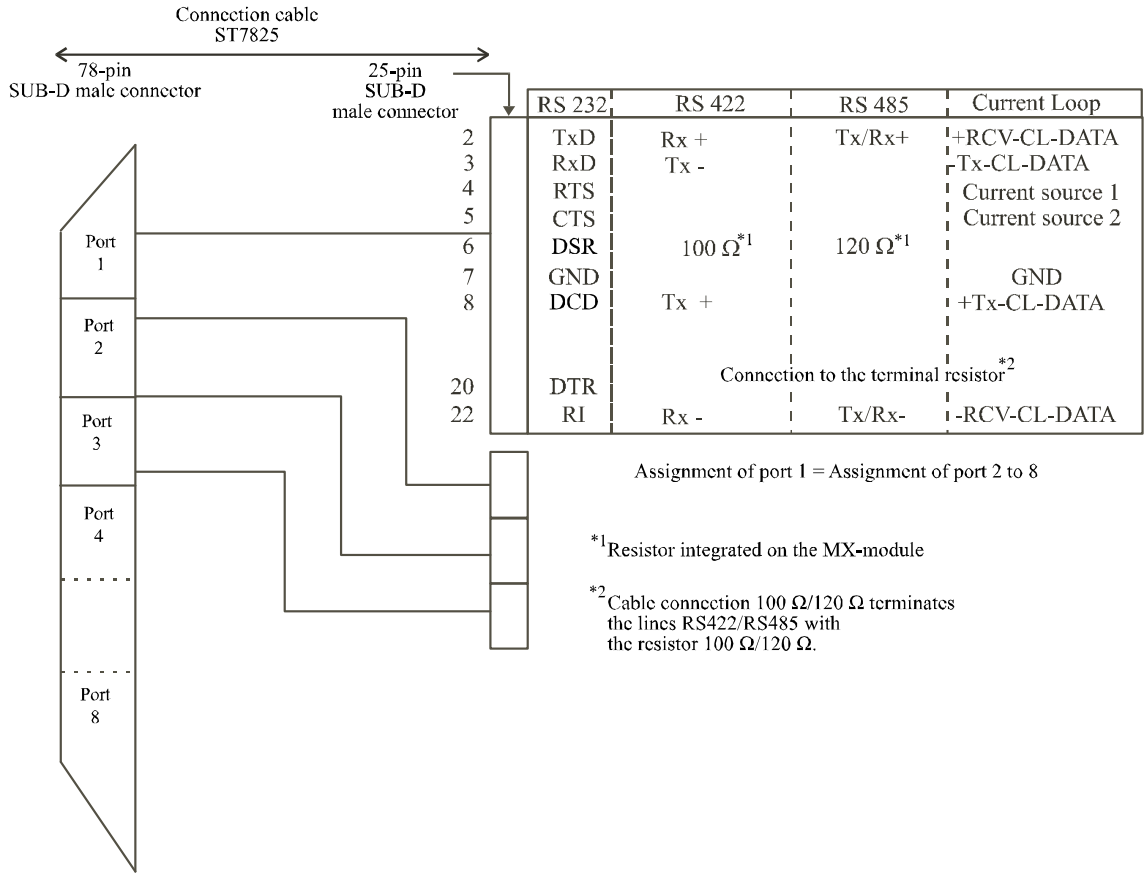


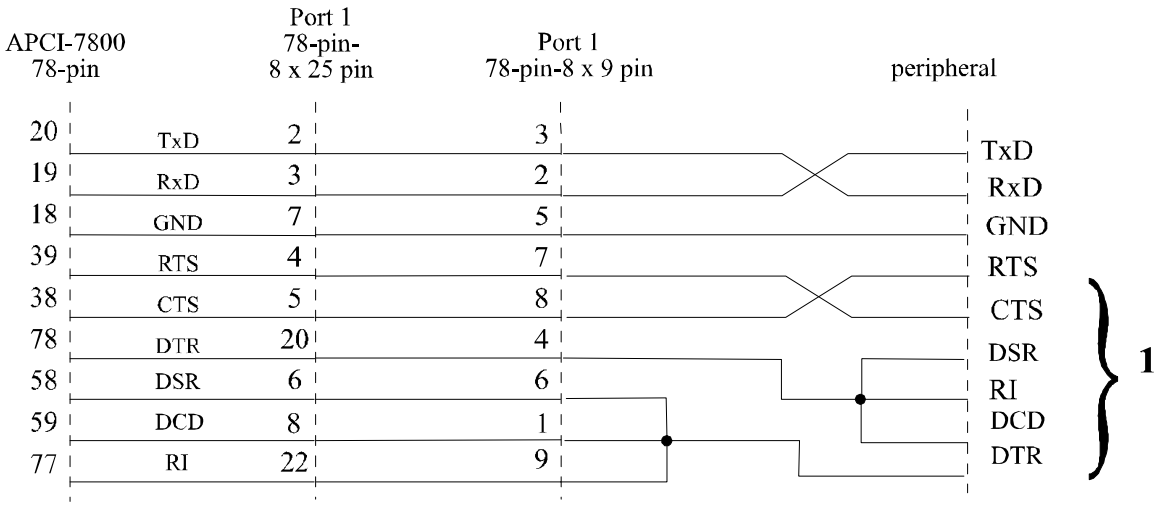
Fig. 7-21: Connection cable ST7825 (8 x 25 pin)



7.8 Connection examples

7.8.1 RS232 cabling

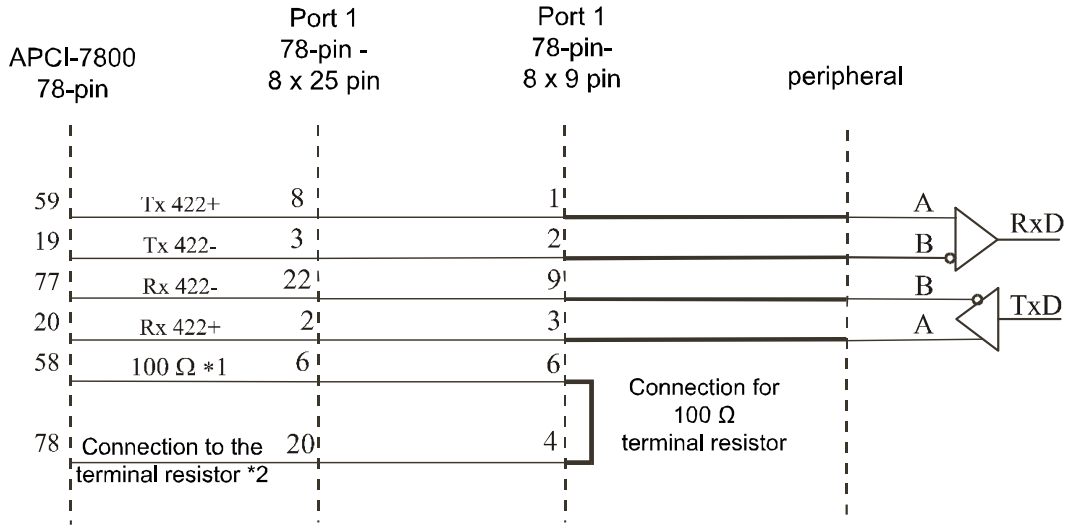
Fig. 7-22: RS232 cabling



1: If the modem control signals are not used, they must be bridged via a wire bridge.

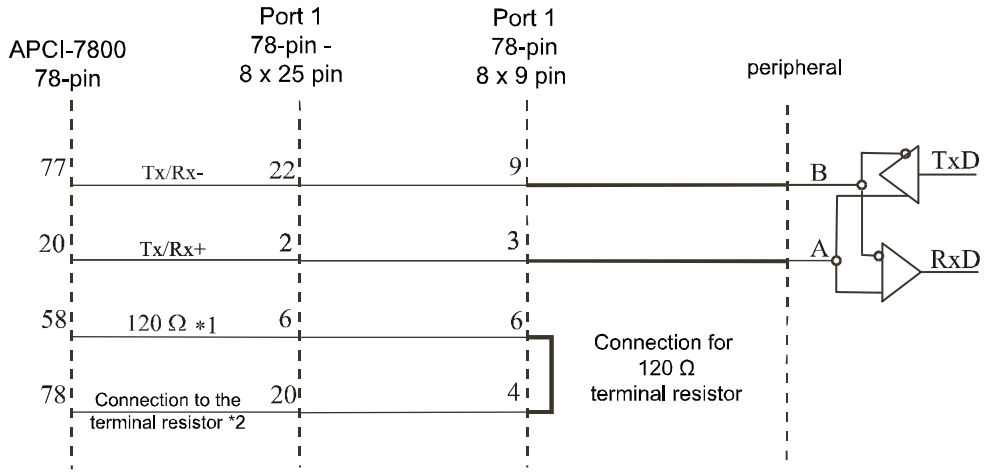
7.8.2 RS422 cabling

Fig. 7-23: RS422 cabling



7.8.3 RS485 cabling

Fig. 7-24: RS485 cabling



7.8.4 Current Loop (20 mA) cabling

Active/passive: When a transmitter and a receiver communicate, one of them has to supply the necessary current. If the transmitter supplies the current, it is active. The receiver is passive. In reverse, if the receiver supplies the current, it is active.

Fig. 7-25: Active transmission/active reception

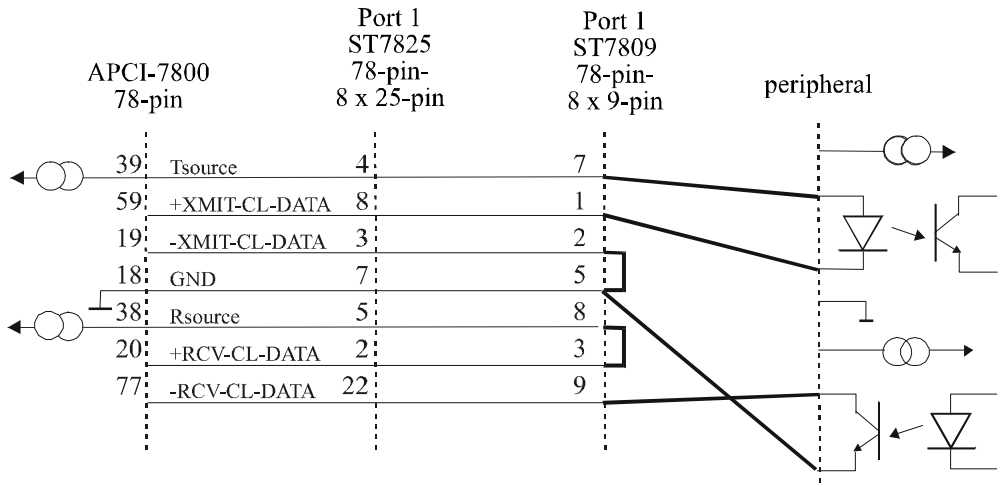


Fig. 7-26: Active transmission/passive reception

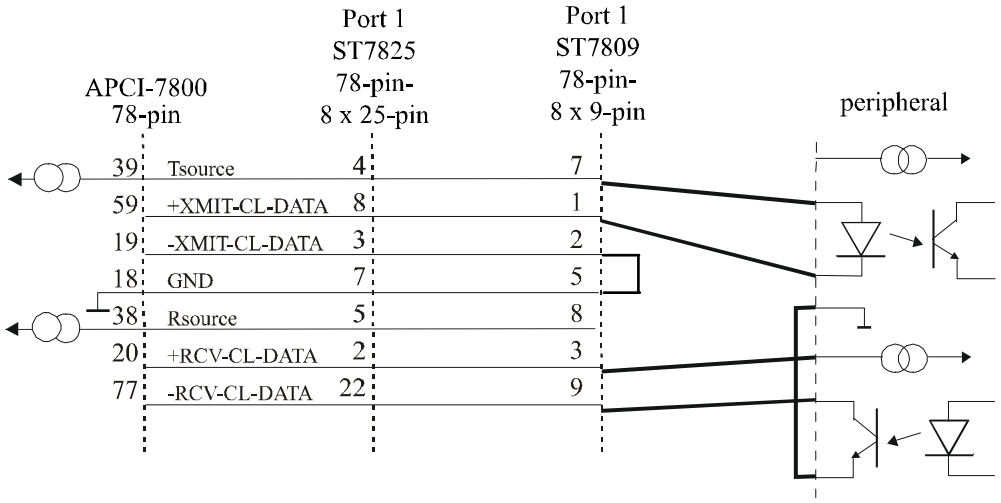


Fig. 7-27: Active transmission/passive reception – 4-fold interface

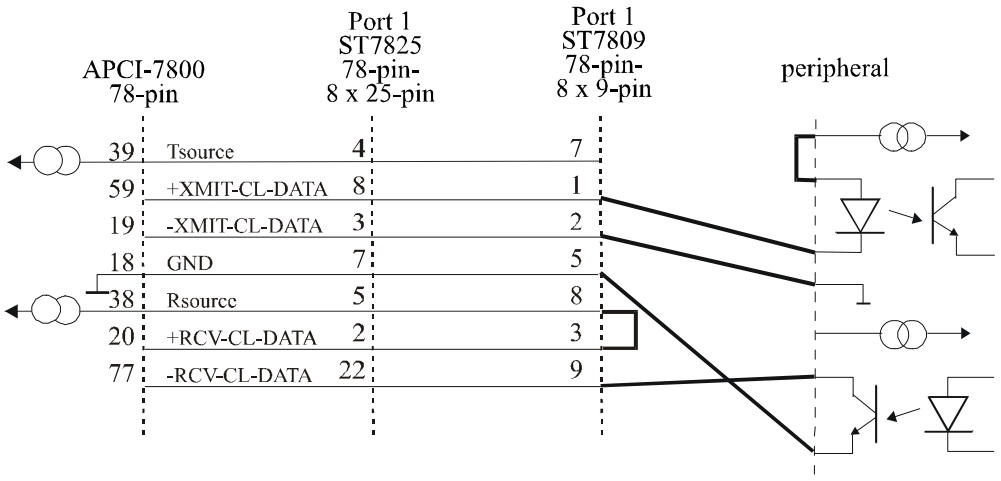
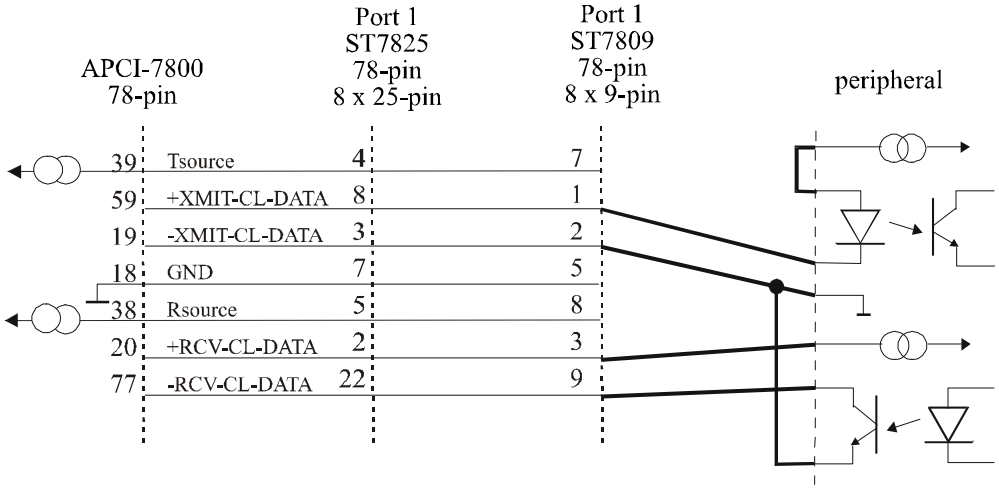


Fig. 7-28: Passive transmission/passive reception



8 TESTING THE BOARD

8.1 Connecting a shorting plug

When using the shorting plug described below and the test program **MTTTY** you can carry out a self-test of the board.

Please note the signal connection of the different ports through the 9-pin **shorting plug** for the test: The recipient will be switched on the transmitter.

Fig. 8-1: Connection of the shorting plug RS232

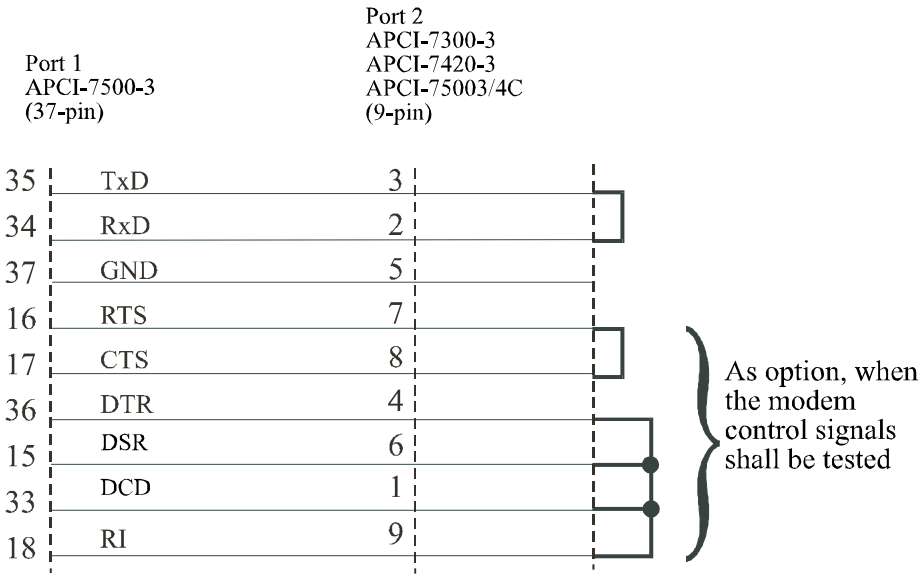


Fig. 8-2: Connection of the shorting plug RS422

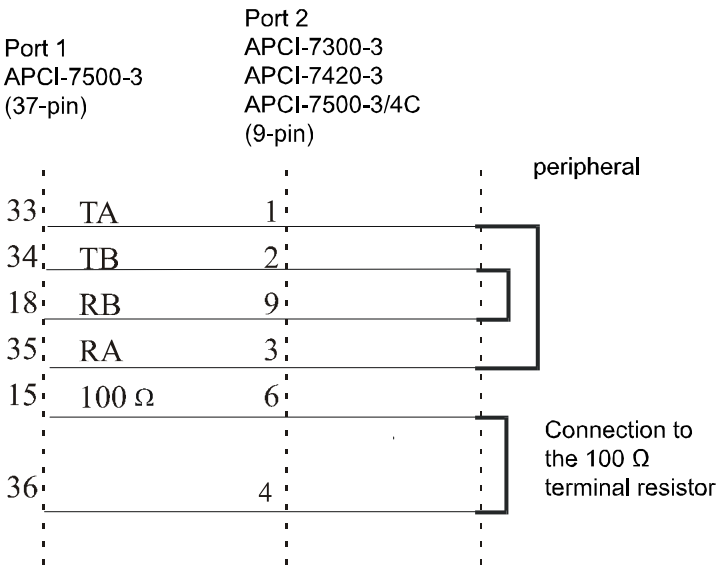


Fig. 8-3: Connection of the shorting plug for 20 mA Current Loop – active transmission/passive reception

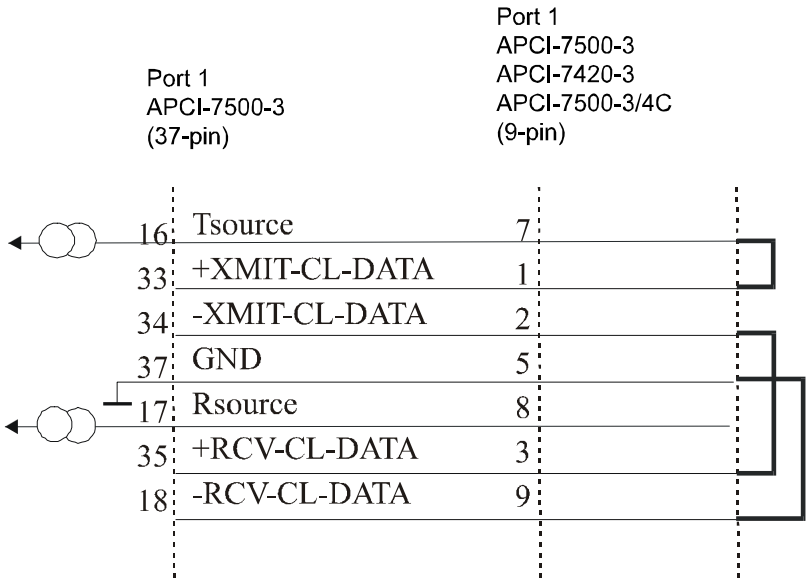
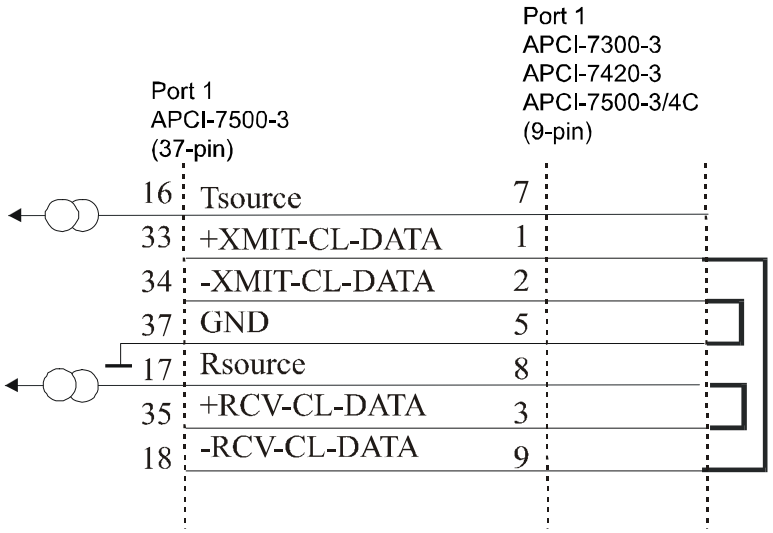


Fig. 8-4: Connection of the shorting plug for 20 mA current Loop – passive transmission / active reception



8.2 Testing the board with the MTTTY program

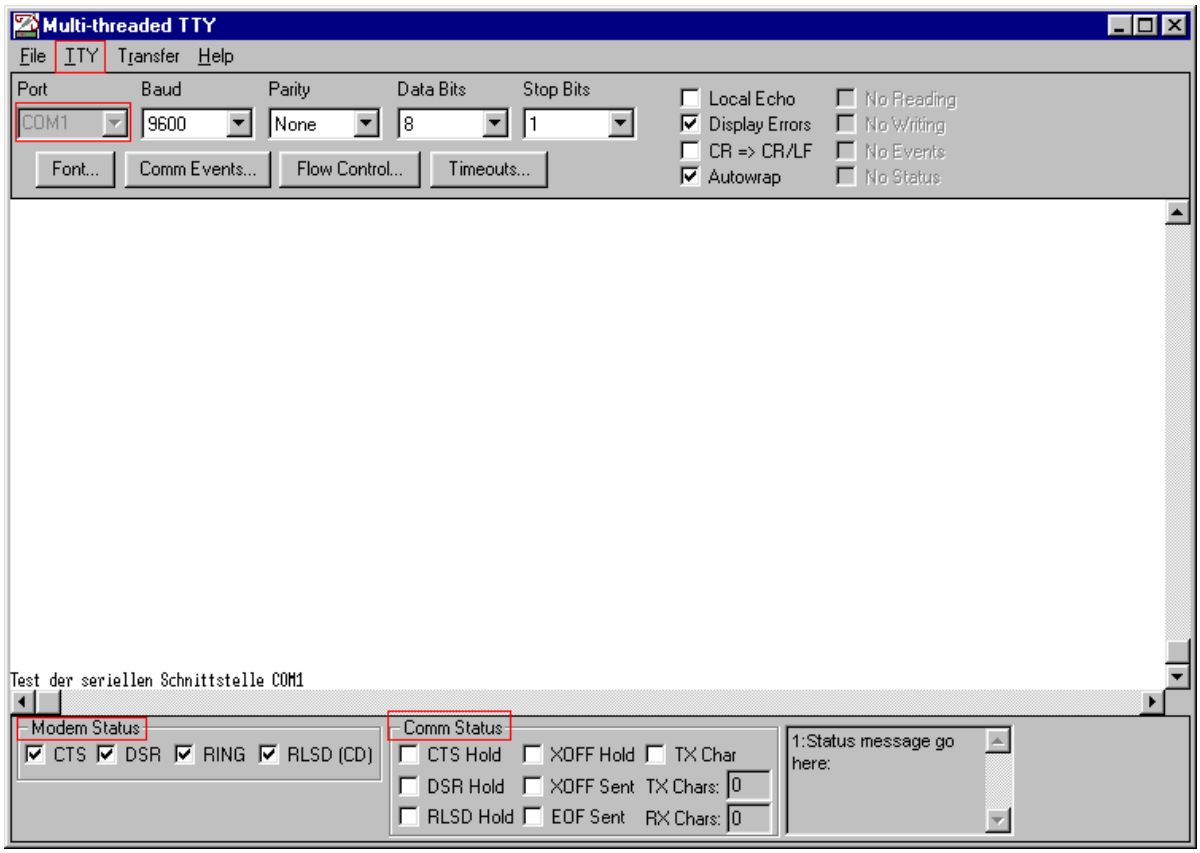
RS422, RS232 and 20 mA Current Loop

♦ **Install the program on your PC.**

The program is delivered on the CD 1 “ADDI-DATA Standard Drivers”.
Under CD/MTTTY start the setup.exe file.

The following window appears:

Fig. 8-5: The MTTTY program



♦ **Select the right COM interface under "Port".**

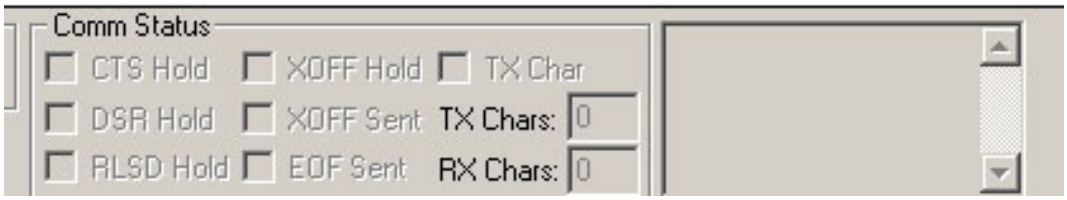
♦ **Connect it with "File/Connect".**

If the shorting plug is connected, each key stroke (= data transmission) must result in the corresponding key character displayed on the screen (= data reception). If the test is successfully carried out, the board works.

Once the port is initialised the state of the "Modem Control Signals" can be read in ***Modem Status***. If the RTS signal is set, the CTS state is displayed under Modem Status. For DTR the 3 other fields are set.

Your settings will be displayed in the lower part of the main menu of the MTTY-program (see figure above) under „Comm Status“ (see figure below).

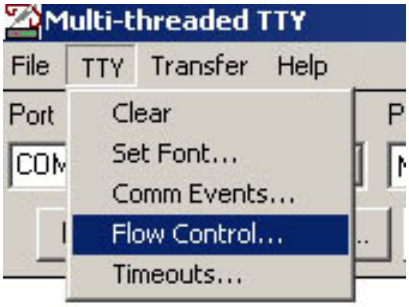
Fig. 8-6: Window: “Comm Status”



You can configure the handshake of the modem control signals according to your application as follows:

- **Click in the menu of the MTTY program on „TTY“ and select„Flow Control“ (see figure below).**

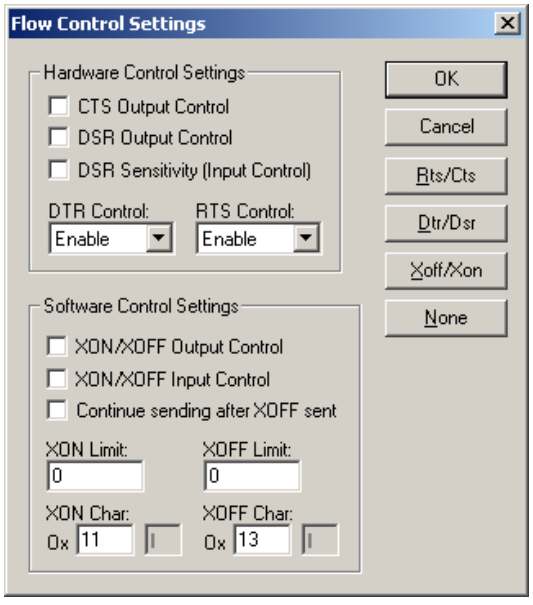
Fig. 8-7: Window: „Flow Control“



After this the window „Flow Control Settings“ appears (see figure below).

- **Here you can do the required settings**

Fig. 8-8: Window: „Flow Control Settings”



Below on the right of the main window of the MTTTY-program there is a text field for error or status messages.

RS485

IMPORTANT!
For the self-test of the RS485 mode a short plug is needed.

This operating mode shall be set firstly via the device manager of Windows XP/2000.

- **In the device manager of Windows XP/2000 select under Settings "RS485 ECHO enable" and confirm with "OK".**

Start MTTTY and check with key press if the interface works correctly.

9 REPLACING THE MODULES

IMPORTANT!
We advise you to send us the board if a module is to be replaced.
If you wish to effect the replacement yourself, consider the following:
Observe the possible combinations according to the intended purpose of the board. Do observe the ***Safety precautions.***
Insert/remove the module carefully according to the following illustrations.

9.1 Replacing the MX modules

Fig. 9-1: Removing the MX module

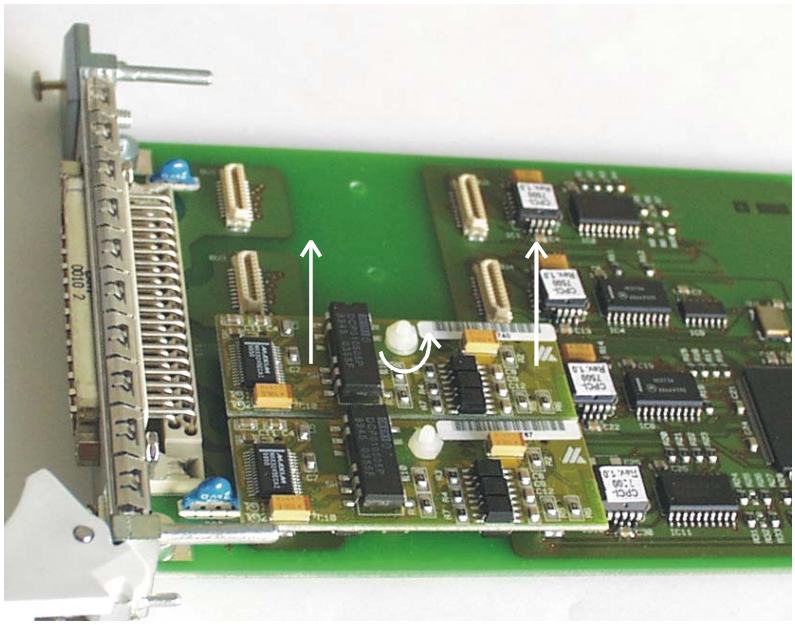
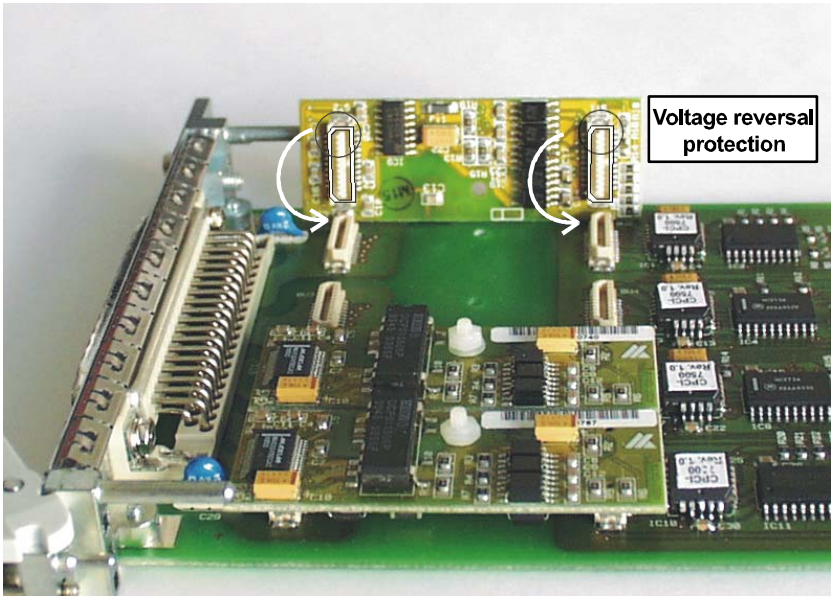


Fig. 9-2: Inserting the MX module



10 GLOSSARY

Table 10-1: Glossary

Term	Description
A/D converter	= *ADC* An electronic device that produces a digital output directly proportional to an analog signal output.
Acquisition	The process by which data is gathered by the computer for analysis or storage.
Baud rate	Serial communications data transmission rate; usually the number of bits-per-second.
D/A converter	= *DAC* A device that converts digital information into a corresponding analog voltage or current.
Data acquisition	Gathering information from sources such as sensors and transducers in an accurate, timely and organized manner. Modern systems convert this information to digital data which can be stored and processed by a computer.
DC voltage	*= Direct current voltage* DC voltage means that the voltage is constant respecting the time. It will always fluctuate slightly. Especially at switching on and switching off the transition behaviour is of high significance.
Disturb signal	Interferences that occur during the transfer caused by reduced bandwidth, attenuation, gain, noise, delay time etc.
Driver	A part of the software that is used to control a specific hardware device such as a data acquisition board or a printer.
Duplex	The ability to both send and receive data simultaneously over the same communications line
Gain	The factor by which an incoming signal is multiplied.
Ground	A common reference point for an electrical system.
Half duplex	Transmission in either direction, but not simultaneous
Handshaking	Exchange of predetermined signals between two devices establishing a connection. Usually part of a communications protocol
Impedance	The reciprocal of admittance. Admittance is the complex ratio of the voltage across divided by the current flowing through a device, circuit element, or network.
Inductive loads	The voltage over the inductor is U=L.(dI/dt), whereas L is the inductivity and I is the current. If the current is switched on fast, the voltage over the load can become very highly for a short time.
Input impedance	The measured resistance and capacitance between the high and low inputs of a circuit.
Limit value	Exceeding the limit values, even for just a short time, can lead to the destruction or to a loss of functionality.
Low-pass filter	Transmitting all frequencies below a certain value
MUX	= *Multiplexer* An array of semiconductor or electromechanical switches with a common output used for selecting one of a number of input signals.
Noise immunity	Noise immunity is the ability of a device to work during an electromagnetic interference without reduced functions.

Noise suppression	The suppression of undesirable electrical interferences to a signal. Sources of noise include the ac power line, motors, generators, transformers, fluorescent lights, CRT displays, computers, electrical storms, welders, radio transmitters, and others.
Operating voltage	The operating voltage is the voltage that occurs during the continuous operation of the device. It may not exceed the continuous limit voltage. Furthermore, any negative operation situations, such as net overvoltages over one minute at switching on the device must be taken in consideration.
Optical isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
Output voltage	The nominal voltage output reading when shaft is rotated to full range, expressed in volts DC /Vo DC)
Parameter	The parameters of a control comprise all fort he control process required numeric values, e.g. for limit values and technological number.
PCI bus	PCI bus is a fast local bus with a clock rate up to 33 MHz. This bus is used for processing a great number of data. The PCI bus is not limited like the ISA and EISA systems.
Protective circuitry	A protective circuitry of the active part is done in order to protect the control electronic. The simplest protective circuitry is the parallel switching of a resistance.
Protective diode	At the input of the integrated MOS (Metal Oxide Semi-Conductor)-circuits used diodes, which operate at the permitted input voltages in the reverse range, but at overvoltage in the transition range and therefore protects the circuits against damage.
Resolution	The smallest significant number to which a measurement can be determined. For example a converter with 12-bit resolution can resolve 1 part in 4096.
RS…	*= Recommended standard number*
RS232	A serial asynchronous communications standard used to connect modems, terminals and printers with serial interfaces.
RS422	Electrical characteristics of balanced-voltage digital interface circuits. Maximum connection distance of 4000 feet.
RS485	The recommended standard of the Electronic Industry Association that specifies the electrical characteristics of drivers and receivers for use in balanced digital multipoint systems.
RTD	*= Resistance temperature detector* An electrical circuit element characterized by a positive coefficient for resistivity.
Sensor	A device that responds to physical stimuli (heat, light, sound, pressure, motion, etc.) and produces a corresponding electrical output.
Settling time	The time required, after application of a step input signal, for the output voltage to settle and remain within a specified error band around the final value. The settling time of a system includes that of all of the components of the system.
Short circuit	A short circuit of two clamps of an electric switch is when the

	concerning clamp voltage is zero.
Short circuit current	Short circuit current is the current between tow short-circuited clamps.
Synchronous	In hardware, it is an event that occurs in a fixed time relationship to another event. In software, it refers to a function that begins an operation and returns to the calling program only when the operation is complete.
Timer	The timer allows the adaptation of program processes between processor and peripheral devices. It usually contains from each other independent counters and can be programmed for several operation types over a control word register.

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